

CALIFORNIA
FACILITY



Al Blackstone



Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

Now ready, Price Sixpence,

HERBARIUM LABELS

FOR THE

BRITISH FERNS AND ALLIED PLANTS;

CONSISTING OF THE

NAMES OF THE ORDERS, GENERA, SPECIES,
AND VARIETIES,

INTENDED FOR PASTING ON

HERBARIUM COVERS.

By THOMAS MOORE, F.L.S.,

ETC., ETC.,

AUTHOR OF THE "HANDBOOK OF BRITISH FERNS," &c.

"Neat and useful for those who take a pride in the beauty of their collections. They are on the same plan as Dr. Lindley's Labels for the Herbarium, and form three quarto leaves."—*Gardener's Chronicle*.

LONDON : GROOMBRIDGE AND SONS,
PATERNOSTER ROW.

[FOR SPECIMENS SEE NEXT PAGE.]

SPECIMENS OF
HERBARIUM LABELS
FOR BRITISH FERNS.

OSMUNDACEÆ.

LYCOPODIACEÆ.

V. POLYSTICHUM, *Schott.*

Lastrea cristata, Presl.

Scolopendrium vulgare, var.

Woodsia hyperborea, R. Brown.
(*W. alpina, Newman.*)

J. C. West

5
058
338

THE HANDBOOK
OF
BRITISH FERNS;

COMPRISING
SCIENTIFIC AND POPULAR DESCRIPTIONS,
WITH ENGRAVINGS
OF ALL THE
INDIGENOUS SPECIES AND VARIETIES,
WITH
Instructions for their Cultivation.

By THOMAS MOORE, F.L.S., &c., &c.,
CURATOR OF THE BOTANIC GARDEN OF THE SOCIETY OF APOTHE-
CARIES, CHELSEA; AND AUTHOR OF "THE POPULAR HISTORY
OF BRITISH FERNS," ETC., ETC.

SECOND EDITION.

LONDON:
R. GROOMBRIDGE AND SONS,
PATERNOSTER ROW; AND
W. PAMPLIN, FRITH STREET, SOHO.

MDCCCLIII.



PREFACE.

THE first edition of this little Manual of the British Ferns was submitted to the patronage of fern admirers and the public, with the desire that it might aid—though in a humble degree—in promoting the growing taste for these charming plants ; and it is no small gratification to the author to know that this expectation has been realised. The present edition, which is much enlarged, and is illustrated with many additional wood-cuts by Mr. P. F. Keir, will, it is hoped, meet with equal approbation, and prove of equal utility.

The object of the author in this Handbook, has been to provide a suitable pocket companion for the students and cultivators of these now favourite plants ; and it is anticipated that the use of the analytical tables of the genera and species, together with the more detailed descriptions and wood-cuts, will in most cases, render the recognition of our wild Ferns an easy task even to the novice.

The classification and nomenclature adopted in the former edition are substantially retained in the

present; for although in these matters, some novel schemes have been proposed, yet the suggestions which have been made, appear to be little else than ingenious devices tending to render the study of the British Ferns more difficult and involved, and rather induce a desire to return to Linnæan simplicity than a disposition to follow the mazy paths of modern innovation.

The peculiarities of venation in the more compound ferns, being more or less affected by the luxuriance of the plants, and more or less varied in different parts of the fronds, it should be recollected, in making use of the following pages, that the basal pinnules on the pinnæ near the centre of a frond of average size, have been selected for description, unless it is otherwise expressed.

The author gladly avails himself of this opportunity to thank all those who have kindly favoured him either with criticisms of his statements or with specimens for examination, and trusts for a continuance of similar communications.

CHELSEA, Aug. 31, 1853.

THE H A N D - B O O K

OF

B R I T I S H F E R N S.

FERNS constitute so beautiful a portion of the creation—whether they ornament our ruins with their light and graceful foliage, wave their bright tresses from our weather-beaten rocks, or clothe with evergreen verdure our forests and our hedgerows—that it seems next to impossible to behold them without experiencing emotions of pleasure. Thus writes a modern historian of the Ferns. But it is not only when located among ruins, on the mountains, or in the forests, that they constitute one of the most beautiful, if not the most lovely, portion of vegetable creation. The pure botanist, indeed, will most favourably regard that race of ferns which cling to their natural localities, and perpetuate their race without the assistance of man. But another more numerous class of observers of nature, while their admiration of ferns in their wild, uncultivated haunts may not be less intense, desire to render them subservient to their domestic gratification; and would fain ornament their gardens with the elegant forms, they may have seen elsewhere covering the rugged rock or the tortuous tree-trunk, or skirting the hedgerows with a feathery fringe of fairy vegetation. This leads to the endeavour to imitate the circumstances, amid mimic rocks and precipices, under which nature cultivates her ferns with so

much success; and the effort, more or less successful as a work of taste and art, can hardly fail to gratify those at least who undertake it. Or it may be that the cultivation of ferns in pots is preferred, and very elegant and interesting are they when so treated; this being, moreover the condition under which very many fern admirers find fern culture most convenient to their circumstances. Those who in pursuing this fancy may be led to adopt the more refined Wardian Case, will find no more beautiful or interesting parlour ornament, than one of those cases piled internally with miniature rocks, studded with living ferns.

The cultivation of ferns is a growing fancy, and one which may well be fostered and encouraged. For whoever admires ferns must be a lover of nature. Their simple ungaudy elegance—superlative though it be—has nothing in it to attract those whose eyes can feast only on the pageantry of floriculture. Flowers may be admired and esteemed for some quality altogether independent of their natural beauty; but nature and ferns are, as it were, inseparable; and there is no race of plants, the culture and study of which is better adapted than they to

“Lead through Nature up to Nature’s God”

THE STRUCTURE OF FERNS.

The ferns form a group of acrogenous plants—that is, flowerless plants having stems and leaves readily distinguishable—which are furnished with a caudex or stem, from which stem issue leaf-like fronds, bearing their peculiar fructification usually at their back, but sometimes on their margin. They bear no flowers in the popular sense, but instead of them certain very peculiar bodies called spore-cases, which contain spores or germinating atoms somewhat analogous to the seeds of flowering plants.

The external parts of ferns are the following ; namely, the root, the caudex, the frond, and the fructification, and these are technically called their external organs.

The true Roots consist of fibres, which are either produced at intervals along the creeping caudex, or where the caudex is not of this creeping habit, they push out on all sides from among the bases of the decayed fronds, of which, in fact the caudex is constituted. These roots are more or less wiry in their texture, sometimes simple, sometimes branched, and in many cases, especially on the younger portions, are clothed with fine hairs or scales. These organs, of course, act as absorbents to supply food to the plants.

The CAUDEX, sometimes called the rhizome or rootstock, is often erroneously regarded as the root. It is, however, a kind of stem, and assumes, in the case of ferns, two very distinct appearances. Sometimes it becomes lengthened and creeping, either beneath or upon the surface of the soil or rock on which it grows ; and sometimes it is scarcely or not at all lengthened, but erect and tufted, forming little

more than a crown, whence the fronds issue. This latter form does, however, in age, occasionally become considerably elongated, even in some of our native species, and these instances afford an imperfect idea of the trunks of the tree ferns of the tropics, which, in some cases, attain fifty or more feet in height. This tendency most decidedly exists in the *Osmunda regalis*, whose erect naked stem may occasionally be met with from one to two feet high; and the same tendency may sometimes be observed in *Lastrea Filix-mas*, *L. Oreopteris*, and *L. dilatata*, and in the *Athyrium Filix-femina*, and *Polystichum angulare*. When of a creeping habit, it usually assumes a tortuous, branching form, and extends itself either on the surface, or a few inches below the surface of the earth, becoming, in fact, a branching prostrate stem, from which the fronds spring up individually and distinct, and more or less widely separated. They are of variable size, sometimes as thick as one's thumb, in other cases as fine as threads, and often thickly covered with hair-like scales. Sometimes the caudex of the stronger growing species extends to a considerable distance as well as depth; that of *Polypodium vulgare* spreads widely in a lateral direction, but the common bracken (*Pteris aquilina*) creeps the most widely, and Newman mentions having met with its under-ground stems extending in some cases to a perpendicular depth of fifteen feet. The creeping caudex where it exists, affords great facilities for propagation; a portion of moderate length, bearing a frond, when separated from the rest, and placed under proper conditions, producing roots in due time, and forming an independent plant. Whether erect and tufted, or lengthened and creeping, their growth according to Hofmeister, takes place only by a continued multiplication of one apical cell, through alternate walls, inclined to the right and left.

The FRONDS are the most conspicuous portion of the plants. Proceeding from the caudex, which is a true stem, they are, in some measure, analogous to the leaves of other plants; and, for this reason, the term *frond* has

been objected to as being unnecessary, that of *leaf* being employed in its stead. The peculiar manner, however, in which the fructification is borne on this part of the plant, seems to render it desirable to maintain a distinctive name. An analogy has been traced between the fronds and the deciduous branches of other plants, but this does not hold good, because though the fronds are in some cases articulated with the stem, especially in those of creeping habit, yet they are not so always. In their incipient condition, the fronds of almost all ferns, are coiled up inwards towards the axis of development, forming a series of convoluted curves, or bent like the head of a crozier. The folding up of the fronds of ferns, as of the leaves of other plants, is termed their *vernation*; and this peculiar form of vernation is called *circinate*. The only British species which differ in their vernation, are the *Botrychium* and the *Ophioglossum*, and in these the parts, instead of being rolled up while undeveloped, are simply folded. The more compound of the circinate species have the divisions of the frond also rolled up in a similar manner: in this case, the larger divisions first open, and the rest afterwards, in order. In many species, the partially developed fronds have a very peculiar and graceful appearance.

When the fronds become fully developed two parts are distinguishable. At the base, more or less extending upwards, is a leafless portion, which is called the *stipes* or stalk, or sometimes by error the stem, the latter term properly belonging to the caudex. The lower part of the stipes, generally, and sometimes even the entire length of the *rachis*, which is the continuation of the stipes through the leafy portions of the frond, is more or less densely covered with paleaceous or membranous scales; in some cases confined to a few small bodies, scattered sparingly near the base of the stipes, but in other cases so large and numerous as to produce a shaggy surface. These scales are most generally regarded as portions of disrupted epidermis; but whatever their origin, they must be regarded as special organs, being very constant in their appearance

and development in the same species. In most of the creeping-stemmed ferns, the base of the stipes is articulated with the stem ; that is, furnished with a natural joint or interruption of the woody fibres, so that in age it separates spontaneously. This is less frequently the case with the tufted growing kinds. In the more highly compound fronds, the rib which runs through their centre is called the primary rachis, and that which runs through the *pinnæ*, the secondary rachis, and so on.

The upper portion of the frond, extending more or less downward, is leafy. This leafy portion offers many states of division, the parts being much influenced in size and number by external circumstances. It is sometimes simple or undivided ; sometimes pinnatifid, or more or less deeply cleft ; sometimes pinnate, or divided into distinct leaf-like divisions, called *pinnæ* ; sometimes bipinnate, that is the *pinnæ* themselves pinnate, this second series of *pinnæ* being called *pinnules* ; sometimes still more compoundly divided, the *pinnules* being either pinnatifid, or even again pinnate. When the *pinnæ* themselves are only deeply cleft, they are said to be pinnatifid. The character of the division of the frond is much employed in distinguishing the species, and is tolerably constant.

The outline of the fronds varies greatly, and is distinguished by the terms which are applied to the same forms in other plants ; the most common being the lance-shaped, triangular, and oval. In their magnitude also the fronds of the British species vary greatly, from two or three inches to five or six feet in length, and from less than an inch to two feet or more in width.

In the form of the divisions there is an almost endless variety. Their texture and colour afford other differences, some being thin and almost transparent, others thick and leathery, and some even rigid ; some pale-green, some deep-green, some blue-green, some brown-green ; some smooth and shiny, others opaque or hairy. Like the leaves of other plants, the fronds of ferns are variable in their duration. In some species they are persistent,

so that either absolutely or with very slight shelter the plants become evergreen; and those possessing this habit are the most valuable for the cultivator where a continuous effect is an object. Other species are fragile, and of short duration, and produced only during the warmer portion of the year, shrinking before the first breath of winter: this class, however, contains some of our most delicately beautiful species.

Allusion has been made to the woody fibre, or vascular tissue which forms the chief substance of the stipes, and is continued onwards into the rachis. This vascular tissue is carried still further, its ultimate ramifications forming the veins which occur in the substance of the fronds themselves. Thus the vascular system may be said to form the framework of the entire plant, which is filled out by cellular expansions. Now it is on some determinate part of these veins that the fructification is borne, and that part, which is more or less thickened, is called the *receptacle*. The vascular system, or *venation*, having thus so close a connection with the production of the reproductive organs, its modifications have been very properly freely used in some of the modern systems of classification.

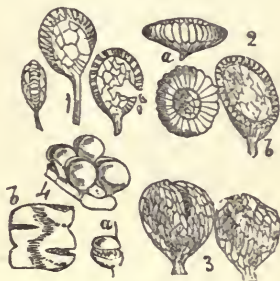
The veins are distinguished by different names according to their relative position. The central rib, which runs along a simple frond, or a simple portion of a compound frond, is the *mid-vein* or *costa*; its branches are called *veins*; the branches of these are the *venules*; and the branches of these again, when present, are the *veinlets*; so that whilst veins are the first series of branchings from the costa, venules are the secondary, and veinlets the tertiary series.

The REPRODUCTIVE ORGANS of ferns consist of *spores*, or germinating atoms, enclosed in *spore-cases*, sometimes called *thecæ*. These spore-cases are mostly furnished with a short pedicel, and have extended nearly or quite around them an elastic vertical or oblique band or ring (*annulus*), the elasticity of which causes them to burst ir-

regularly when they reach maturity. In a few instances they are sessile, and without the ring, opening by regular valves. The ferns have in consequence been sometimes divided into *annulate* and *exannulate* groups. When the fructification is borne on the under surface, or what is called the back of the frond, it is said to be *dorsal*, and such ferns are said to be *dorsiferous*; but when it is protruded from the edge of the frond, it is said to be *marginal*. The spore-cases in all annulate ferns are collected together into groups of various outline called *sori*, which sometimes form distinct spots, and in other cases take a linear or oblong arrangement. In the marginal-fruited group the spore-cases are collected around the extremities of the veins which are extended beyond the margin. The exannulate ferns have their spore-cases collected upon the sides or surface of contracted fronds. The spore-cases in certain of the annulate groups spring from the surface of the fronds without any covering, and in other groups rise as it were from beneath the cuticle, which, in this case, is pushed up in the form of an investing membrane, called the *indusium*, or sometimes *involucre*. Hence are formed two classes, the *indusiate* and the *non-indusiate* ferns. The term involucre seems more properly confined to those ferns whose spore cases have no covering, but a membrane interposed between them and the frond.

The spore-cases arise directly from the veins, either on the under surface or the margin of the fronds. They seem to have been for a long time considered as special organs, not having any very clear analogy with anything that occurs in flowering plants. Dr. Lindley, nowever, suggests that they may be considered as minute leaves, having the same gyrate mode of development as the ordinary leaves or fronds of the tribe; their stalk being the petiole, the annulus the midrib, and the case itself the lamina with the edges united. This view appears to have originated in a persuasion that there was no special organ in ferns to perform a function which in

flowering plants is executed by modifications of leaves. The theory, however, applies only to the gyrate ferns. In those which are furnished with a transverse ring, he suggests, either, that the midrib of the young scale, out of which the case is formed, is not so much developed; or the case is a nucleus of cellular tissue, separating both from that which surrounds it and from its internal substance, which latter assumes the form of spores, in the same way as the internal tissue of an anther separates from the valves under the form of pollen. In *Ophioglossum*, there is no spore-case beyond the involute contracted segments of the spore-bearing leaf. The vertical ringed spore-cases, when mature, split suddenly with a transverse fissure, thus ejecting the spores. Those which are furnished with an horizontal ring, on the other hand, burst vertically. The spore-cases of the exannulate ferns are regularly two-valved. The accompanying figures will convey an idea of the external appearance of these organs.



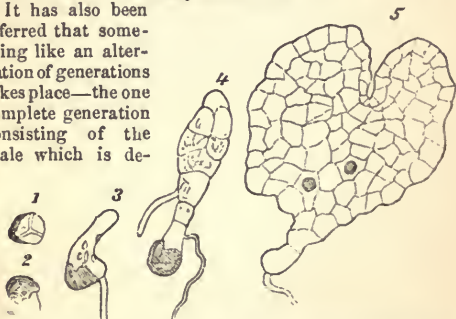
Spore Cases.

1. Polypodiæ: 2. Hymenophylliæ, (a) *Trichomanes*, (b) *Hymenophyllum*: 3. Osmundacæ: 4. Ophioglossacæ, (a) *Botrychium*, (b) *Ophioglossum*.

The spores are minute sphaeroidal bodies, arranged without order within their cases. They differ obviously from seeds in having no special organs, consisting merely of a homogeneous mass of cells, and they differ also in other material respects. In true seeds the radicle or young root, and the plumule or young shoot, are developed from determinate points, nothing of which occurs in the development of ferns from the spores. On the contrary, they consist merely of a small vesicle of cellular tissue growing indifferently from any part of its surface, and becoming divided into others, which are again multiplied, and become enlarged until they form a small green leaf-like germinal scale, from which in due time the proper fronds are produced.

The germination of the spores of ferns has lately excited much inquiry, the result of which leads to the inference that something like sexuality exists among all the higher groups of so-called Cryptogamous plants, a kind of fertilisation taking place on a development from the spore called the *pro-embryo*, which in the ferns takes the form of a leaf-like scale, as already mentioned.

It has also been inferred that something like an alternation of generations takes place—the one complete generation consisting of the scale which is de-



Figs. 1 to 5. The spore and its stages of development ; fig. 5 showing two antheridia.

veloped from the spore, and bears the parts through which fertilisation takes place ; the other, which results from this latter act, being of a totally different form, producing stems, and leaves, and spores.

The facts from which these inferences are drawn have been variously, and even conflictingly, stated by different observers. Suminski, who seems in great measure to have revived the inquiry, states that the spore first produces a filamentous process, in the end of which cell-development goes on until it is converted into a small

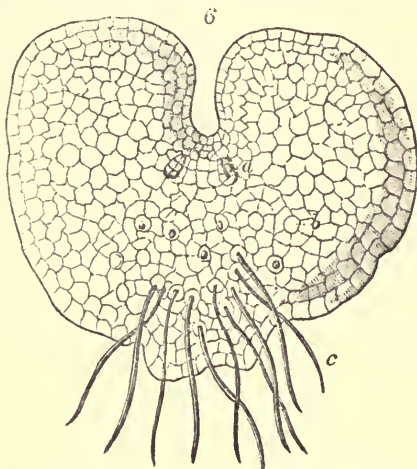
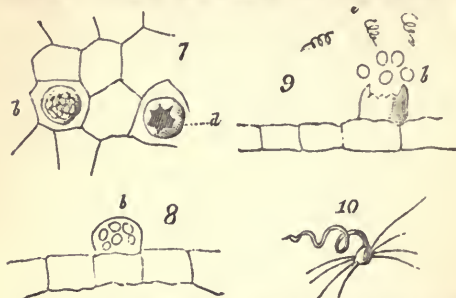


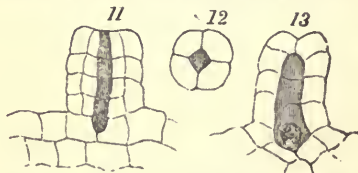
Fig. 6. Germinal frond; *a*, ovules; *b*, antheridia; *c*, root-fibrils. leafy scale, of very delicate texture, possessing hair-like radicles on its lower surface. From this lower surface become developed in variable numbers cellular organs

of two kinds. One kind, the more numerous, called "antheridia," consist of somewhat globular cells seated on



Figs. 7 to 10. Antheridia: fig. 7, *b* containing vesicles, *d* burst; 8, side view of *b*; 9, the same, discharging the vesicles; which latter discharge the spiral filaments *e* and fig. 10.

and arising from single cells of the leafy scale; these produce each in its interior a number of minute vesicles, within each of which is coiled up a spiral filament, consisting of a delicate thread with a thickened vescicular club-shaped extremity, which is furnished with cilia. At a certain epoch the globular cell bursts and discharges the vesicles, and the enclosed spiral filaments then make



Figs. 11 to 13. Ovule: 11, side view; 12, summit seen from above; 13, vertical section, showing embryo cell in the cavity.

their way out. The other kind of organ exists in fewer numbers, and is called the "ovule." At first it appears as a little round cavity in the tissue of the pro-embryo, lying near its centre, and opening on the under side. In this cavity lies a small globular cellule. Suminski states that while the ovule is in this state, one or more of the spiral filaments enter the cavity, and come in contact with this central globular cellule. The mouth of the cavity is bounded by four cells which grow out from the general surface into a blunt cone-like process; these cells divide and grow out until the ovule exhibits externally a cylindrical form, composed of four tiers of cells, the uppermost of which converge and close up the orifice. In the meantime, the vesicular head of one of the filaments has penetrated to the globular cellule, becomes enlarged and undergoes multiplication, and in course of time displays itself as the embryo producing the first frond, and the terminal bud whence the regular stem is developed. Such is the substance of Suminski's statement.

Hofmeister, who confirms these statements in the main, and has distinctly observed the young plant, or rather the terminal bud of the new axis produced within the "ovule," believes its supposed origin from the spiral filament to be a delusion, and regards the globular cellule in the centre of the "ovule" as itself the rudiment of the stem, the embryo originating from a free cell produced within it. Mettenius also, who observed a nucleus within the globular cellule, believes the development of the embryo to consist in the division of this into two, which go on dividing to produce the cellular scale-like structure of the first frond. Mercklin states that the spiral filaments swarm round the "ovule" in numbers and do penetrate it, though he saw this very rarely; and moreover in the tubular portion of the "ovule," almost in every case, he saw, at a definite epoch, certain club-shaped granular mucilaginous filaments, and these he has found in contact with the globular cellule. He concludes that these club-shaped filaments are transformed spiral fila-

ments which have penetrated the "ovule," and that they probably contribute to the origin or development of the terminal bud already mentioned.

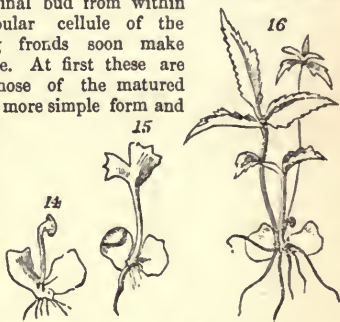
The foregoing statements seem to be supported by varied and irrefragable evidence; but the fact of the fertilisation rests on the authority of Suminski and Mercklin alone. There seems, however, sufficient reasons to *assume* that such really takes place. The production of certain intermediate forms of ferns and of allied plants, of the nature of hybrids, suggestive that something like hybridisation does occur among the flowerless plants, furnishes one of these reasons.

After the first growth has commenced by the organisation of a terminal bud from within the free globular cellule of the "ovule," young fronds soon make their appearance. At first these are very unlike those of the matured plant, being of more simple form and

more delicate texture; but they gradually acquire more and more the texture and form peculiar to their species, though, with the exception of a few annual kinds, they are

a couple of years, or in many cases much longer, in arriving at a perfect state.

The conditions chiefly necessary for the germination of fern spores are sufficient heat and abundant moisture; that is to say, a calm moist atmosphere, accompanied by the degree of heat proper to the species. Those which inhabit cold climes require only a close cold frame;



Figs. 14 to 16. Young plants of *Pteris serrulata* from the spores.

the species of temperate regions are best reared beneath a hand-glass in a greenhouse; and the tropical species should be placed in a hothouse.

A convenient way of managing them is the following : —Half-fill some shallow wide-mouthed pots with broken crocks, and on this put a layer of about two inches of turfy peat soil and mellow loam mixed with soft sand-stone broken in small lumps of the size of peas; this compost should not be much consolidated. Next, shake or brush very gently over a sheet of white paper, a frond of the species to be propagated; the fine brown dust thus liberated consists of the spores, in greater or less quantity, intermixed more or less with the spore cases. This dust is to be regularly and thinly scattered over the rough surface of the soil, which is immediately to be covered with a bell-glass, large enough to fit down close within the pot. The pots are at once to be set in feeders, and these are to be filled up with water; they may either be placed under a hand-glass in a cold frame, or in a greenhouse or stove, as may be most proper. The first indications of germination will consist in the appearance of little semi-transparent green scales. The supply of water must be kept up, and the glasses kept over the young plants. When two or three fronds are developed, the glasses should be tilted on one side for a short time every day, and ultimately entirely removed, the pots still being retained under a hand-glass. After a week or two they may be taken up, carefully separated, and potted singly in small pots. The young plants should still be kept under a hand-glass until established, and then gradually inured to the degree of exposure proper for the mature plants. Fern spores spring up in myriads on the surface of the soil, or on any undisturbed continually moist surface, about the growing plants, from which they are dispersed as they ripen on the fronds. In hothouses this is so much the case that they sometimes become troublesome weeds.

In their internal structure, ferns are the most highly

developed of all the acrogenous plants. In the lower of these flowerless orders of plants the whole plant consists merely of cellular tissue; but in the more highly developed orders, among which Ferns hold the highest rank, both vascular and woody tissues are found. The woody matter of the stems of ferns consists chiefly of large dotted ducts embedded in hard plates of thick-sided elongated tissue, which usually assumes an interrupted sinuous appearance, but occasionally according to Brown, forms a complete tube. The same kinds of tissues are continued along the stipes and rachis, where also annular ducts occur; and this vascular system is carried on throughout the frond, in the ribs and veins which traverse the various leafy parts into which it is divided.

It is this connection of the veins of the fronds with the entire vascular system, which gives to venation its great value in the systematical arrangement of these plants. These veins are either simple or branched, or dichotomously forked, with their points free—that is, disunited; or their apices are joined together, so as to form what is called netted venation.

From some part of these veins the spore cases arise; and this part, as already mentioned, is called the receptacle. It occurs sometimes at the apex—sometimes between the base and apex of the free veins—sometimes where two or more veins unite, but always at some determinate point.

THE DISTRIBUTION AND AFFINITIES OF FERNS.

The British ferns are widely distributed throughout the United Kingdom, occurring more or less abundantly from north to south and from east to west, except where local peculiarities are unfavourable to their existence. On the summits of our loftier mountains they occur but rarely, but here their comparative absence is to be attributed not so much to the actual elevation as to the bleakness of the situation, which condition is generally unfavourable to ferns. They are found, however, existing under a variety of circumstances; and though undoubtedly a calm and moist atmosphere is, in a general sense, most favourable to their development, there are but few species which are strictly confined to localities where these conditions prevail. When growing in drier and more exposed localities, they follow the law which affects vegetation generally, being in such situations smaller, more rigid in texture, and often less divided; and it is an interesting inquiry, how far variations of appearance thus induced become permanently fixed characters, transmissible to succeeding generations.

The limits of this volume do not admit of the distribution of the British species being stated in detail. Some attempt, however, may be made to indicate their range by means of the tabular formulary inserted on the following pages (18-19). This table is constructed on the basis of Mr. Watson's "Botanical Provinces," which we have also adopted in the *Popular History of British Ferns*, and of which a more detailed account may be found in Mr. Watson's valuable contribution to botanical geography, the *Cybele Britannica*. These provinces, as here adopted, have the following limits:—(see page 20.)

[illegible]

(Botanical Provinces of Great Britain.)

1. *Peninsula*.—Cornwall, Devon, Somerset.
2. *Channel*.—Hants, Sussex, Dorset, Wilts.
3. *Thames*.—Herts, Middlesex, Kent, Surrey, Berks, Oxford, Bucks, Essex.
4. *Ouse*.—Huntingdon, Bedford, Suffolk, Norfolk, Cambridge, Northampton.
5. *Severn*.—Warwick, Gloucester, Monmouth, Hereford, Worcester, Salop.
6. *S. Wales*.—Radnor, Brecon, Glamorgan, Carmarthen, Pembroke, Cardigan.
7. *N. Wales*.—Anglesea, Denbigh, Flint, Montgomery, Merioneth, Carnarvon.
8. *Trent*.—Leicester, Rutland, Lincoln, Notts, Derby.
9. *Mersey*.—Cheshire, Lancashire (excl. northern part).
10. *Humber*.—York.
11. *Tyne*.—Durham, Northumberland.
12. *Lakes*.—Westmoreland, Cumberland, N. of Lancashire, Isle of Man.
13. *W. Lowlands*.—Dumfries, Kircudbright, Wigton, Ayr, Renfrew, Lanark.
14. *E. Lowlands*.—Peebles, Selkirk, Roxburgh, Berwick, Haddington, Edinburgh, Linlithgow.
15. *E. Highlands*.—Stirling, Clackmannan, Kinross, Fife, Perth, Forfar, Kincardine, Aberdeen, Banff, Nairn, Elgin or Moray incl. Inverness E. of Loch Erricht.
16. *W. Highlands*.—Inverness W. of Loch Erricht, Argyle, Dumbarton; the Isles adjacent from Bute and Arran to Skye.
17. *N. Highlands*.—Ross, Cromarty, Sutherland, Caithness.
18. *N. Isles*.—Orkney, Shetland.
19. *W. Isles*.—Outer Hebrides.
20. *Ulster (N.)*.—Antrim, Londonderry, Donegal, Tyrone, Down, Armagh, Monaghan, Fermanagh, Cavan.

21. *Connaught (W.)*.—Leitrim, Sligo, Galway, Roscommon.
22. *Leinster (E.)*.—Longford, Westmeath, Meath, Louth, Dublin, Kildare, King's, Queen's, Wicklow, Wexford, Carlow, Kilkenny.
23. *Munster (S.)*.—Waterford, Tipperary, Clare, Limerick, Cork, Kerry.
24. *Channel Isles*.—Guernsey, Jersey.

The proportion which the ferns bear to the phænogamous portion of the flora of the British Isles, may be taken in round numbers, as 1 to 35. In Scotland, they are computed to hold the proportion of 1 in 31. The geographical distribution of ferns, generally considered, shows an enormous disproportion between them and the rest of the flora in certain tropical islands: thus, in Jamaica, they are 1-9th of the phænogamous plants; in New Guinea, they bear the proportion of 28 to 122; in New Ireland, they are as 13 to 60; and in the Sandwich Isles, as 40 to 160. It is clear from the collections of Wallich, that ferns must form an important feature in the vegetation of the Indian Archipelago. Upon continents, however, they are found to be far less numerous: thus, for example, in equinoxial America, Humboldt does not estimate them higher than 1-36th; and in New Holland, Brown finds them 1-37th. They decrease in proportion towards each pole; so that in France, they stand as 1-63rd; in Portugal, as 1-116th; in the Greek Archipelago, as 1-227th; and in Egypt, as 1-971st of the flowering plants. Northwards of these countries, their proportion again augments, and they are found to form 1-31st of the phænogamous vegetation of Scotland, 1-35th in Sweden, 1-18th in Iceland, 1-10th in Greenland, and 1-7th at North Cape. The Adder's tongues (*Ophioglossaceæ*) are most abundant in the islands of tropical Asia; they occur, however, in the West Indies, and are not uncommon in the temperate latitudes of both hemispheres.

As to their affinities, the ferns approach flowering plants through the Cycads, a group of Gymnogens, which may be considered as closely allied to them, on account of the imperfect degree in which the vascular system of that order is developed, of their pinnate leaves with a gyrate venation, and of their naked ovules borne on the margins of contracted leaves, as the spore-cases are upon the leaves of *Osmunda* and *Ophioglossum*. To Conifers, another group of Gymnogens, they also advance very closely through *Salisburia*, whose leaves might be mistaken for those of a fern. Among Acrogens, their affinity with Horsetails (*Equisetum*) is not very obvious, consisting chiefly in the presence of annular vessels, and in the absence of flowers. The Club-mosses (*Lycopodium*) which have some relationship, are distinguished readily by their axillary spore-cases, which dehisce by regular valves. The Pepperworts (*Marsileaceæ*) are, according to Lindley, much more remote. These latter, however, the Horsetails, Club-mosses, and Pepperworts, are popularly considered as being specially "fern-allies."

GENERAL HINTS ON FERN CULTURE.

Special hints on the cultivation of each species will be given when we come to describe them. In this place, however, some general rules will be laid down, in order to avoid subsequent repetition.

PROPAGATION.—Ferns are propagated either by sowing the spores as seeds, or by dividing the plants. When the latter mode is adopted it is generally best to remove the plant from the soil, and shake away all, or as much as possible, of the soil from the roots, in order that the parts may be clearly seen. Those ferns which have the caudex creeping, are generally increased without difficulty by dividing it so that each portion intended for a plant has one or more fronds, and a portion of the roots retained with it, in an uninjured condition. Such divided portions should be potted in the light soil recommended for the more delicate sorts, and should be kept close in a cool moist frame until established. They must be potted with the caudex buried, or fixed on the surface, according to the habit of the kind under treatment. Those having a tufted or erect caudex require a different process. If there is more than one heart or crown as the tuft of fronds which surround each distinct axis is termed, the point of a knife is to be inserted carefully at the base, separating them so that each crown retains a portion of the roots; these are then potted in the soil proper to the species, and kept in a frame until established, as in the other case. Sometimes those which have the erect caudex, form but a single crown, and to attempt to divide this would be to destroy the plant. In such cases the only course, if pro-

pagation must be attempted, is to destroy, by some gentle process, the axis or extreme point of growth, to wait patiently until the lateral crowns which *may* thus be forced to develop themselves, have gained some strength, and then to divide as before; only, in this case, very much more care is necessary in the process of division. The spring season, just before growth recommences, is the best time for these operations.

The most interesting mode of propagation, however, is by the spores. The mode of raising these described at p. 15, may serve for the mere purpose of propagation. Where, however, exactness in the results is an object, or where it is desired to watch the progress of development, either in a cursory way, or more minutely by means of a microscope, other methods will be found more convenient, and I know of none which can be more strongly recommended than that which has been described in Mr. Ward's valuable book, "On the Growth of Plants in Close-glazed Cases," by Mr. Deane, of Clapham, in a letter the substance of which I will transcribe:—

Mr. Deane's intention was to procure some soft porous potter's ware material, that should readily imbibe and retain moisture, upon which to sow the spores. He, however, met with a peculiarly fine and soft sandstone, which was equally adapted to the purpose, and with this his experiments were made. The stone was prepared by breaking it into pieces of from one to two inches square, and less than one inch thick, the faces being rendered parallel and smooth by rubbing on a flat stone. The object of thus adjusting the size and smoothness of the pieces of stone, was to facilitate their being placed for observation on the stage of a microscope. Before sowing the spores, the prepared pieces of stone were baked in an oven to destroy any organic matters which might be lurking about them. They were then moistened with distilled water, and covered with bell-glasses, preparatory to receiving the spores. The spores were obtained by laying recently-gathered fronds with mature fructification be-

tween two sheets of white paper, pressing them slightly to keep them in place. In three or four days an abundance of spores was discharged from the spore-cases, and they were attached to the damp surface of the stones by inverting the latter on them, care being taken that they did not lie too thickly. The stones were kept moist, and covered by glasses. In this way many species were raised without a failure; and by this process the kinds sown were raised with certainty, which is not often the case with the ordinary process, stray spores in most cases intruding themselves in some unsuspected way, and leading to disappointment. Any one who makes a garden of this kind under a bell-glass, must observe that the material used is so porous that the requisite amount of moisture may pass to the top by capillary action, when applied to the bottom of it. Also, that with an abundance of light, the sun must not shine directly on it. "No kind of vegetation," concludes Mr. Deane, "that I am acquainted with has ever struck me with such wonder, admiration, and delight, as the little crops of Ferns thus raised."

SOIL.—Nearly all ferns like the soil more or less sandy. A mixture suitable for all the purposes of pot-culture may be thus compounded: Take of fibry mellow loam, light spongy peat, and well-decayed pure leaf-mould, equal parts, and mix them with sand. For all the stronger-growing species use the soil in the rough state, to which it will be reduced by merely chopping it fine with the spade, and add to it an eighth part of clean but coarse sharp sand. For all the smaller and more delicate species, rub the soil through a sieve with half-inch square meshes, and be careful to rub through as much of the fibry portion as possible; add to it a sixth part of clean silver sand. In both cases mix up with this compost a fourth part of crushed sandstone, broken to the size of walnuts, and smaller for the vigorous growers, and of the size of hazel nuts and smaller for the more delicate sorts.

POTTING.—Pot ferns must always have thorough drainage. One fourth of the depth of the pot should be

occupied by drainage material, which may consist of potsherds broken up to the sizes of nuts and walnuts, rejecting the finer portions. On this a thin layer of sphagnum moss should be spread, to prevent the soil washing or settling down among the drainage. Then, in potting, lay a little soil on the moss, spread out the roots as much as possible, and fill in the soil gradually, working it with the fingers well among the roots. When the pot is filled, consolidate it by a few smart taps on the potting-bench, and by pressing firmly with the fingers, so that the soil may be settled down close and firm, and fill the pot to within from half an inch to an inch of the level of the rim. The soil should be in a half-dry state when used—never wet. The small ferns seldom require pots larger than five inches in diameter, and good plants of the large ones may be had in pots from twelve to eighteen inches in diameter. March or April is the best time for re-potting. If the soil is open, and the pots not too full of roots, avoid re-potting, as they are better not disturbed; but if the texture of the soil has become too close from the decay of its fibry particles, if the drainage has become imperfect, or if the pots are too full of roots, re-pot by all means, shaking away, in the former cases, as much of the old soil as possible, and rectifying the errors, and in the latter case affording a larger pot, if the limit has not yet been reached. If the latter is the case, reduce the roots without bruising those retained, and re-pot in the same sized pot.

WATERING.—All ferns love moisture, therefore while they are growing they should be well supplied. The supply to the roots must vary according to the habits of the species; but through the growing season, or from May till September, the plants will be benefited by a daily syringing over the fronds, repeated in the evening of all hot days. Dryness at the root, or in the atmosphere, is very hurtful to them. At the same time, it is to be remembered that if by reason of continued dull or damp weather, the amount of water supplied is producing anything like a

soddening—or continued *wetness*, as distinguished from mere dampness—of the soil, the supply must be checked; for no ferns except the few which are naturally bog plants, will thrive in soil approaching this condition. Soft or at least aërated water should always be used, and the water used for syringing should be scrupulously clean, or the fronds will soon become disfigured by it. If the amount of dampness in the atmosphere is producing mouldiness in the fronds, give more air and less moisture until the tendency is checked.

SITUATION.—Pot ferns are best kept in a cool shady frame or pit. In such a place, they may stand during winter, with just enough water to prevent dryness of the soil, and no more; and in such a place, the atmosphere being kept moist, by the free use of water, they will in summer reach their full perfection of growth. In winter nothing but watering occasionally need be done, except covering just to exclude severe frosts. In summer no sunshine should smile upon the then growing plants, which must be shaded with scrupulous exactness if it is desired to preserve that delicacy of tint and texture which in the ferns are so much prized. In summer allow a free circulation of air, limited on the one hand, so that the temperature does not rise much beyond that of a shady wood; and, on the other, so that the atmosphere does not become at all parched. Many of the strong-growing kinds, though more beautiful when kept in a pit or frame, do not absolutely require to be so treated, but may be set in a cool shady place out-doors; and if so, the pots should be plunged as a protection to the roots against sudden drought. Most of the British ferns will bear a little moist heat, when they are making their growth; but it must not be too high, nor should it be too long-continued.

GLAZED CASES.—The close-glazed cases invented by Mr. Ward are invaluable aids in fern-culture; and besides this, they are, when well filled with living plants, very instructive and suggestive ornaments in the comfortable parlours of the affluent. By their aid, too, the culture

of a few plants,—and none better adapt themselves to this treatment than the ferns—may be made to throw a gleam of satisfaction across the often cheerless path of the town-imprisoned poor. There is no obstacle except that of size to prevent all our British ferns being grown in glass cases suitable to occupy the window of a living-room ; and all the smaller species are admirably suited for such a structure.

The form of a Wardian case, and of the stand which supports it, may be various; but its principle, so far as our present subject is concerned, is, that a closely-glazed covering surrounding the plants, shall admit of the supply of the necessary moisture in the atmosphere in which they are kept, which cannot be the case in the ordinary atmosphere of a living-room. Such cases should be nearly air-tight, but need not be strictly so; indeed, it is better to have them provided with means of ventilation to be used in moderation. The bottom of the case should be a deep zinc or other metal tray, through which the moisture cannot penetrate: this for the sake of cleanliness. At its lowest part a vent should be provided, which vent is to be kept stopped by a plug or valve, except when it is required to let off the superfluous moisture after watering. In this tray a miniature rock should be built with sand-stone and cement; the ferns planted on it, and watered. The case may then be closed, and need not be opened, except for an hour occasionally if there is any symptom of too much moisture, until the plants are thoroughly established. When they begin to grow, it may be opened for an hour daily. The soil must not be suffered to get wet; it should be only just moist. When the plants get too large, or require re-arrangement, they may be taken up, divided and replanted, or young plants substituted. This is best done in spring just before growth recommences.

HARDY FERNERY.—An out-door fernery should occupy a shady position, in the neighbourhood of water. It should consist mainly of natural or artificial rock, on which the ferns may be planted, with water here in mimic

cataracts dashing its spray around ; there losing itself in cavernous recesses ; now spreading out in a glassy pool ; anon meandering among the bases of the rocks, and by evaporation yielding the moisture so essential to the well-being of the ferns. A few ivy-covered pollard-stumps, and some pathways winding to the most important points, complete the arrangements necessary to a tolerably complete hardy fernery, in the disposition of which it is obvious there is ample scope for the display of taste, or to follow the dictates of fancy. Any such scenery, however, covered by a glass-roof would form an admirable fernery, in which many species from temperate climates, might be associated with the natives of our own country. Such a covering of glass, while it facilitates the cultivation of the more delicate species, adds much even to the beauty and gracefulness of the more hardy and free-growing kinds, and renders the charms of all much more enduring than is possible if they are exposed to the vicissitudes of our clime.

Some of the hardy ferns might be used with advantage in beds in the flower-garden as relief plants, in situations not too much exposed to wind and drought. Thus, a bed having the centre filled with strong roots of *Lastrea Filix-mas*, or *Polystichum angulare*, or *Lastrea dilatata*, and the outer portion occupied by high-coloured dwarf flowering plants, would present a highly effective contrast. So, entire beds of ferns here and there, presenting in themselves the elements of contrast, would have a good effect : for example, *Lastrea Filix-mas*, surrounded by *L. fœnisecii*, and this again by *Scolopendrium vulgare crispum*. Any of these would succeed in a tolerably sheltered situation, and would even flourish if the soil could be kept damp. Of course if any degree of shade could be secured, that would be beneficial to the ferns ; even if only in a degree which would do little injury to flowering plants.

THE CLASSIFICATION OF FERNS.

The characters by which ferns were originally brought into groups such as those now called genera, were derived from the shape and division of the frond. This principle of association, however, as the knowledge of species became extended, was found to produce vague and unnatural results, and generic or family characters came to be sought in the organs of reproduction, the shape of the clusters of spore-cases being taken as their most obvious feature. This, too, in its turn, though affording better discriminative marks than the former, proved to be insufficient. Then it was that the presence or absence of an indusium, or cover to the sori, and its form and attachment, came to be included among the characteristic marks of genera; and this combination was found to mark out much more satisfactory and natural-looking groups, than the characters which had been previously employed. But a still better and more discriminating mode was wanting, and this was at length found to exist in the peculiarities of structure of the venation or vascular system of the frond, and in the connection of these veins with the sori. Among the earliest proposers of these features as characteristic of generic differences, the names of Robert Brown in connection with living ferns, and Adolphe Brogniart with fossil remains, stand prominent; and the subsequent labours of various botanists, especially of Presl in Germany, and J. Smith in this country, have led to its very wide adoption. Indeed, it is made the basis of most modern systems of classifying ferns; and, taken in conjunction with the peculiarities of the fructification, renders little further change necessary or to be desired.

A binary arrangement, by which it is proposed to classify ferns according to the mode in which their fronds are developed from the caudex, has lately been suggested by Mr. Smith of Kew. The facts upon which this arrangement is founded have been already explained (pp. 3—6). Those ferns whose caudex produces fronds laterally, that is to say from their sides, not their apex, form one division, which it is proposed to name *Eremobrya*. Those which have terminal fronds, that is fronds from their apex, not their sides, constitute the other division, which is to be named *Desmobrya*. The application of this principle has not yet been explained in detail. Its adoption, however, would lead to the entire breaking up of the groups and genera now recognised. As, therefore, the habit and manner of growth cannot be admitted to form characters of greater value than those derived from the parts of fructification in ferns any more than in flowering plants; and moreover as the adoption of such a principle of classification would introduce another element of confusion into the already difficult and involved nomenclature of this race of plants, it seems better to regard the suggestion rather as an ingenious proposition than as the foundation of a system of classification for practical use. Such radical changes indeed, in the case of plants already so well classified as the ferns, and all other unnecessary alterations in the grouping or naming of genera or species, ought, we think, to be deprecated, as tending more to bring their study into disrepute than as affording any real or practical advantages. At the same time, it must be admitted that the systems now in use, do here and there present difficulties and objections, but not more important ones than would be likely to arise in the application of any other system by the light of our present limited and ever-varying knowledge. Mr. Smith's original suggestion, moreover, has something very natural about it, being somewhat tantamount to the divisions of exogens and endogens among flowering plants; so that were we

beginning to classify ferns *de novo*, it would probably be found desirable to follow it up. For the reasons already adduced, however, we shall adhere to that system of classification which is based on the vascular system of the frond, taken in conjunction with its fructification.

Mr. Newman, following up the suggestion of Mr. Smith, has proposed to form four groups, which would produce the following arrangement:—*Eremobrya*: those whose fronds are produced from any part of the rhizome except its point, and are always articulated with it; *Chorismobrya*: those whose fronds are produced as in the preceding class, but are not articulated; *Desmobrya*: those whose fronds are produced only at the point of the erect or suberect corm-like rhizome, and are not articulated; *Orthobrya*: those having the veneration straight. This scheme is open to the same objections as that of Mr. Smith.

In the wider sense the FERNS (called also *Filices*)—that is to say, those vascular acotyledonous or acrogenous plants which bear on the backs or edges of their leaves one-celled spore-cases containing spores of one kind only—comprise the groups of *Polypodiaceæ*, *Gleicheniaceæ*, *Schizæaceæ*, *Osmundaceæ*, *Marattiaceæ*, and *Ophioglossaceæ*; but three only of these, the *Polypodiaceæ*, *Osmundaceæ*, and *Ophioglossaceæ*, are represented in the British Flora, and these and their subdivisions are distinguished by the following characters:—

I.—POLYPODIACEÆ—Ferns whose veneration is circinate, and whose spore-cases girt by an elastic jointed ring having no valves, burst irregularly. This includes the following subdivisions:—

* *Ring of the spore-cases vertical.*

I. Polypodiææ—Dorsal-fruited ferns, whose sori have no proper indusium or scale-like cover.

II. Aspidiææ—Dorsal-fruited ferns, whose sori invested by scale-like or capillary indusia, are roundish in outline, and spring from the back of the veins.

iii. Asplenieæ=Dorsal-fruited ferns, whose sori, covered by scale-like indusia, are oblong or elongated in form, and spring from the sides of the veins.

iv. Blechnæ=Dorsal-fruited ferns, whose linear sori, covered by special indusia, are borne longitudinally between the midrib and margin of the divisions of the frond.

v. Pterideæ=Dorsal-fruited ferns, whose continuous or interrupted aggregations of spore-cases are covered by the reflexed margin of the frond, altered in texture and becoming indusioid.

* * *Ring of spore-cases horizontal or oblique*

vi. Hymenophylleæ=Marginal-fruited ferns, whose spore-cases are clustered around veins (receptacles) which project from the frond, and are surrounded by urn-shaped or two-valved involucre.

II.—OSMUNDACEÆ=Ferns whose vernation is circinate and whose two-valved spore-cases have no elastic ring.

III.—OPHIOGLOSSACEÆ=Ferns whose vernation is plicate, and whose two-valved spore-cases have no elastic ring.

The distinguishing characters of the genera are the following :—

I. (1.)—Polypodieæ.

Sori circular, exposed	1. Polypodium.
Sori circular, becoming confluent and concealed by the reflexed margins of the frond, unaltered in texture	2. Allosorus.
Sori linear forked	3. Gymnogramma.

I. (II.)—Aspidieæ.

- Sori within inferior involucre, whose margin is divided into incurved capillary segments 4. *Woodsia*.
- Sori beneath cucullate or hooded indusia, attached by their broad base 5. *Cystopteris*.
- Sori beneath circular peltate indusia, attached at their centre 6. *Polystichum*.
- Sori beneath reniform indusia, attached at the notch on their indented side 7. *Lastrea*.

I. (III.)—Asplenieæ.

- Sori beneath oblong curved sometimes horseshoe-shaped indusia, attached along their concave edge, the free margin fringed with capillary segments; venules free 8. *Athyrium*.
- Sori beneath simple elongate straight indusia, attached along their exterior side; venules free 9. *Asplenium*.
- Sori beneath elongate straight indusia lying in proximate parallel pairs, and opening along the centre of each (twin) sorus; venules free... 10. *Scolopendrium*.
- Sori elongate scattered, all except the lowest on each pinna growing from the anterior side of the veins, hidden among imbricated chaffy scales; indusium obsolete; venules anastomosing at the margin 11. *Ceterach*.

I. (IV.)—Blechnæ.

- Sori forming continuous lines parallel with the midrib, and within the margin 12. *Blechnum*.

I. (v.)—Pterideæ.

- Sori forming a continuous marginal line covered by the reflexed edge of the ultimate divisions of the frond altered in texture 13. *Pteris*.
- Sori transverse, growing on the reflexed apices of the lobes of the frond, which are altered in texture..... 14. *Adiantum*.

I (vi.)—Hymenophylleæ.

- Receptacles exserted, surrounded at the base by urn-shaped involucre of the same texture as the frond ... 15. *Trichomanes*.
- Receptacles included, surrounded by two-valved involucre of the same texture as the frond 16. *Hymenophyl-* [lum.]

II.—Osmundaceæ.

- Fructification forming irregular, densely-branched panicles at the apex of the fronds 17. *Osmunda*.

III.—Ophioglossaceæ.

- Fructification forming irregularly-branched panicles terminating a separate branch of frond 18. *Botrychium*.
- Fructification forming two-ranked simple spikes terminating a separate branch of frond..... 19. *Ophioglossum*.
-

The species and varieties of each genus may be known by the following among other select characteristics :—

I.—POLYPODIUM.

Fronds pinnatifid, segments obscurely serrate	1. vulgare —
Fr. pinnatifid, segments coarsely serrate	<i>var.</i> serratum
Fr. and segm. pinnatifid, lobes acute serrate	<i>var.</i> cambricum —
Fr. and segm. pinnatifid, lobes obtusish crenate-serrate	<i>var.</i> hibernicum —
Fr. pinnate below, pinnae pinnatifid	2. Phegopteris —
Fr. bipinnate lanceolate, pinnules pinnatifid	3. alpestre —
Fr. ternate deltoid smooth membranaceous	4. Dryopteris —
Fr. ternate elong. delt. glandular-mealy subrigid	5. Robertianum —

II.—ALLOSORUS.

Only one British species	1. crispus. —
--------------------------------	----------------------

III.—GYMNOGRAMMA.

Only one British species	1. leptophylla —
--------------------------------	-------------------------

IV.—WOODSIA.

Fr. lanceol. very hairy-squamose, pin. oblong or ovate-oblong ...	1. ilvensis
Fr. linear, hair-scales few, pin. shortly triangular ovate	2. hyperborea —

V.—CYSTOPTERIS.

Fr. lanceolate bipinnate	
pnls.* ovate acute pinnatifid, teeth acute.....	1. <i>fragilis</i>
pnls. lanc. pinnatif, teeth longer, acute	<i>var. angustata</i>
pnls. oblong or obl.-ovate	
distinct, pinnatifid, teeth blunt	<i>var. dentata</i>
imbricate, lobed, teeth shallow blunt, pinnæ deflexed	<i>var. Dickleana</i>
Fr. lanceol. subtripinnate, with linear cut segm.....	2. <i>alpina</i>
Fr. triangular tripinnate	3. <i>montana</i>

* The pinnules about the middle of the frond should be examined.

VI.—POLYSTICHUM.

Fr. pinnate, pnls. spine-serrate, very rigid	1. <i>Lonchitis</i>
Fr. bipinnate	
thick or rigid, pnls. sessile, attach. by acute-ang. base	
pnls. ovate acute subfalcate aristate auriculate	2. <i>aculeatum</i>
pnls. oblong obtusc, very thick not rigid, aristate auriculate.....	<i>var. obtusum</i>
pnls. nearly all confluent, not auricled	<i>var. lobatum</i>
lax, pnls. stalked, with an obtuse angled base	3. <i>angulare</i>
lowest pnls. almost pinnate	<i>var. subtripinnatum</i>
pnls all small nar. very acute, proliferous	<i>var. angustatum</i>

VII.—LASTREA.

Venules indiscriminately soriferous

fr. without glands, caudex creeping 1. **Thelypteris**

fr. glandular beneath, caudex tufted 2. **Oreopteris**

Anterior venules only (of medial fertile pinnules) soriferous

Serratures not spinose-mucronate

Indusium with a plain margin

pnls. with broad attachment or connected, serrate 3. **Filix-mas.**

pnls. distinct deeply lobed, lobes serrate *var. incisa*

pnls. confluent scarcely serrate, dwarf *var. abbreviata*

fr. and pin. multifid-criped at apex *var. cristata*

Indusium fringed with stalked glands 4. **rigida**

Serratures spinose-mucronate

Scales of stipes ovate, ind. entire, *i.e.*, without glands

fr. nar. linear pinnate, pnls. all connected. basal pnls. nearly

equal, crenato-serrate or lobed with aristate teeth ... 5. **cristata**

fr (fert.) nar. lin. lanc, bipinn. below, pnls. mostly adnate,

the basal ones nearly equal, inciso-serrate or lobed,

with aristate teeth.....

fr. nar. oblong lanc. bipinn., posterior basal pnls. much

longest, all lobed or pinnatif. with aristate teeth.....

var. uliginosa

var. spinulosa

Scales of st. lanc. entire, ind. with stalked marg. glands
scales two-col., the centre dark

- fr. lanc. ovate or subtriang-ovate, bi-tri-pinnate.....
fr. nar. ovate apex elong. bipinn. pnls. rounded at apex,
ends of lobes serrate
fr. nar. subtriang-ovate, bipinn. pnls. decurrent.....
fr. subtriang. ovate, bipinn. dwarf
fr. lin.-lanc. bipinnate, pin. short deltoid

scales whole-coloured, narrower

- fr obl.-ovate bipinn., very glandular.....

scales whole coloured, broader

- fr lanc.-ovate bipinn, very glandular

Scales of st. lanc. lacin., ind. with sessile marg. glands 7. *fœnisecl*

VIII.—**ATHYRIUM.**

- Fr. nar. lanc. erect, pnls. convex distinct linear acute 1. *rhæticum*

Fr. broad lanceolate, pinnules flat

normal —

- pnls. oblong-lanc. distinct, sori irregular crowded

pnls. ovate stalked, gashed, imbricate, sori uniserial distant
from midrib

- pnls. oblong, connected at base, sori uniserial near midrib ...

pnls. oblong, connect. crowded, fr. spread, much nar. at base

6. *dilatata*

var. collina

var. Smithii

var. dumetorum

var. angusta

var. maculata

var. glandulosa

2. *Filix fœmina*

var. latifolium

var. molle

var. marinum

monstrous—		
tall, fr. and pin. symmet. multifid-crisped at apex.....		<i>var. multifidum</i>
tall, fr. and pin. unsymmet. multifid at apex		<i>var. ramosum</i>
dwf., fr. branched, apex dilated, and multifid-crisped.....		<i>var. crispum</i>
IX.—ASPLENIUM.		
Midvein of pnls. and lobes evident		
fr. bipinnate lanceol., sori short		
small narrow, primary rachis winged smooth	1.	<i>fontanum</i>
larger broader, prim. rachis not winged scaly	2.	<i>lanceolatum</i>
fr. bi-tri-pinnate triangular, sori long		
segm. of pnls. triangular-ovate.....	3.	<i>Adiantum-nigrum</i>
segm. of pnls. linear-lanceolate		<i>var. acutum</i>
fr. pinnate		
rachis winged	4.	<i>marinum</i>
rachis not winged		
all black, pnls. entire or crenate.....	5.	<i>Trichomanes</i>
all black, pnls. pinnatifid-incised		<i>var. incisum</i>
green above	6.	<i>viride</i>
Midvein wanting		
fr. bipinnate, indusium jagged	7.	<i>Ruta-muraria</i>
fr. linear pinnate, indusium entire	8.	<i>germanicum</i>
fr. nar. lanc. two or three-cleft, indusium entire	9.	<i>septrionale</i>

X.—SCOLOPENDRIUM.

Fr. oblong strap-shaped entire. sori within margin.....	1. vulgare
Fr. narrow obtuse irregularly lobed fertile	<i>var.</i> polyschides
Fr. with a double marg., <i>i.e.</i> , as it were split longitudinally and deeply lacerate-lobed, each surface fertile except the upper	<i>var.</i> marginatum
Fr. much undulated, usually barren	<i>var.</i> crispum
Fr. dilated at apex and cut into acute lobes	<i>var.</i> lobatum
Fr. forked (often repeatedly) towards the extremity, fertile (or sometimes undulated and then barren)	<i>var.</i> multifidum
Fr. with branched stipes, branches dilated at their apices, and divided into numerous unequal crisped lobes.....	<i>var.</i> ramosum
Fr. with the margin cut into lobes or branches which are multifid-crisped at apex	<i>var.</i> laceratum

XI.—CETERACH.

Only one British species	1. officinarium
--------------------------------	------------------------

XII.—BLECHNUM.

Only one British species	1. spicant
--------------------------------	-------------------

XIII.—PTERIS.

Only one British species	1. aquilina	—
inferior pnls. pinnatifid.....	var. vera	
all the pnls. entire.....	var. integerrima	

XIV.—ADIANTUM.

Only one British species	1. Capillus-veneris	—
--------------------------------	---------------------	---

XV.—TRICHOMANES.

Only one British species	1. radicans	—
--------------------------------	-------------	---

XVI.—HYMENOPHYLLUM.

Pinnæ vertical, involucre compressed serrate.....	1. tunbridgense	—
Pinnæ unilateral, invol. inflated entire	2. unilaterale	—

XVII.—OSMUNDA.

Only one British species	1. regalis	—
--------------------------------	------------	---

XVIII.—BOTRYCHIUM.

Only one British species	1. Lunaria	
--------------------------------	------------	--

XIX.—OPHIOGLOSSUM.

Only one British species	1. vulgatum	
--------------------------------	-------------	--

(2) *lucida* (Lamour.)

GENUS I.

POLYPODIUM, Linnæus

POLYPODY.

GENERIC CHARACTER.—*Sori* circular naked, terminal or subterminal on the back of the veins. *Veins* free; midvein distinct; venules simple or forked.

The type of this genus is the common *Polypodium vulgare*, which Newman injudiciously and unnecessarily separates from *Polypodium*, and proposes as a new genus with Blume's sectional name *Ctenopteris*. The other species do not indeed well associate with this, but in the absence of satisfactory distinctive characters, it is better not to disturb them.

The name is derived from *poly* many, and *pous, podos* a foot; from the many foot-like divisions of the caudex.

1. **Polypodium vulgare, Linnæus.** — Common Polypody.—Fronds deeply pinnatifid, linear-oblong acuminate, lobes broad linear obtuse or acute, obscurely serrate, the upper smaller.

POLYPODIUM VULGARE, Linnæus: Eng. Bot. t. 1149: Sm. Eng. Fl. iv. 267: Hook and Arn. Fl. 566: Bab. Man. 408: Florig. Brit. iv. 37: Newm. 111: Franc. 21.—CTENOPTERIS VULGARIS Newm. App. xxix.

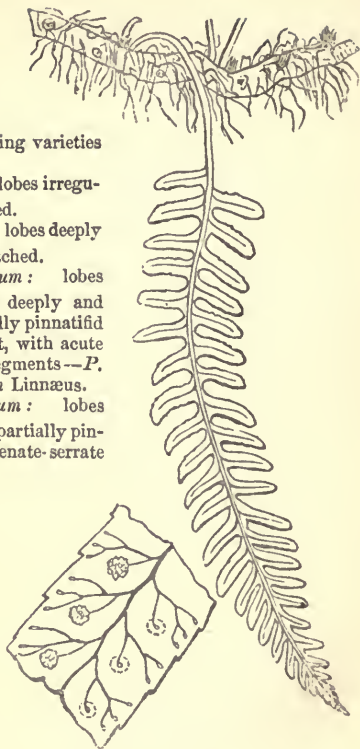
The following varieties occur:—

β. bifidum : lobes irregularly forked.

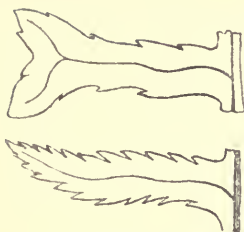
γ. serratum : lobes deeply serrate-notched.

δ. cambricum : lobes lanceolate deeply and interruptedly pinnatifid throughout, with acute serrate segments—*P. cambricum* Linnæus.

ε. hibernicum : lobes lanceolate partially pinnatifid crenate-serrate bluntish.



[*Polypodium vulgare*.]

[*P. vulgare* β and γ]

on the lower part are deeply lobed.

Other slight variations occur. One of these, with taper-pointed lobes, is called *acutum*; and the var. *bifidum* is sometimes more than two-lobed, and is then called *proliferum*.

The Common Polypody has a creeping caudex, as thick as one's finger, densely covered while young with brown taper-pointed paleaceous deciduous scales, becoming bare in age, and throwing out, as it progresses, densely hairy branching

Sometimes entire fronds of the variety ϵ are deeply crenate-serrate when it is the var. *sinuatum* of Willdenow. At other times the upper part of the frond only is thus crenated, while the primary lobes

[*P. cambricum*.]

fibrous roots. The fronds perish in winter when exposed to frost, and are renewed in May and June; but under shelter become persistent: they generally acquire a drooping habit. The stipes is usually nearly equal in length to the leafy portion of the frond, and at the base is distinctly articulated with the caudex. The fronds are pinnatifid, with a more or less elongated oblong outline, and vary from three to six, twelve, or even eighteen inches in length: the lobes are flat, linear-oblong, parallel, shorter towards the apex of the frond, obscurely serrated, and somewhat blunt-pointed, though occasionally acute; sometimes (var. *bifidum*) cleft at the end into diverging lobes; sometimes deeply and often bluntly serrated (var. *serratum*). In the var. *cumbricum* the frond is much broader, though not always ovate, as described, and the lobes themselves are irregularly jagged or slashed, so that it is twice pinnatifid. The venation of the common form is thus arranged: each lobe has a tortuous prominent mid-vein, from which alternately on either side the venules proceed; these lateral veins are divided into four branches (veinlets) in vigorous fronds, or into three branches in smaller fronds, or in some of the very strongest fronds occasionally into five branches. The lowest venule, always on the anterior side, reaches about midway to the margin, and terminates when fertile in a sorus or cluster of spore-cases, or when barren in a club-like transparent head; the other branches terminate in similar club-like heads, which form a line near the margin of the lobes. The sori are circular, entirely without an indusium, and at an advanced stage, often become crowded and confluent. The fronds are usually all fertile, the sori being produced on the upper part of each.

This very common species is pretty generally distributed over the United Kingdom; and is also met with in various other parts of Europe, in Asia, and in Africa. The decaying stumps and living trunks of trees, old thatched roofs, walls, moist rocks, and shady banks, are the positions which its creeping caudex prefers.

This plant is invested with an antiquated medicinal reputation. The caudex has a sweetish taste, which, by long boiling, is said to become bitter; an infusion of the fresh caudex is considered as a mild laxative. A mucilaginous decoction of the fronds was formerly, and probably still is used in country places as a cure for colds and the whooping-cough, in children: for this purpose the matured fruitful fronds gathered in the autumn are dried, and when required for use are slowly boiled with coarse sugar. Polypody is still used as a demulcent by the Italians. The fronds yield a considerable quantity of carbonate of potass on being burnt; the ashes are boiled in water, and the liquor strained and evaporated until the crystals are formed.

This fern is well adapted for planting on artificial rockwork, and among rustic work formed of the stumps of old trees, especially delighting to extend its creeping caudex over a decaying mossy tree-stump. It will, however, grow in almost any situation, provided there is free moisture about its roots, but is much finer in the shade than when exposed. When depending from the trunks and exposed roots of old trees, on deep shady banks, under which circumstances it is often seen naturally, it must be ranked as a decidedly ornamental object. It is readily increased by dividing the branched caudex.

2. Polypodium Phegopteris, Linnæus.—Mountain Polypody, or Beech Fern.—Fronds pinnate below; pinnæ narrow lanceolate, the lower pair deflexed standing forward, pinnatifid, with linear-oblong blunt lobes; upper pinnæ united at the base.

POLYPODIUM PHEGOPTERIS, Linnæus: Eng. Bot. 2224: Sm. Eng. Fl. iv. 269: Hook and Arn. B. Fl. 566: Bab. Man. 408: Florig. Brit. iv. 41: Newm. 115: Franc. 23.—LASTREA PHEGOPTERIS, Newm.—POLYSTICHUM PHEGOPTERIS, Roth.—GYMNOCARPIUM PHEGOPTERIS, Newm. App. xxiii.

The Mountain Polypody has a tough, slender, dark-coloured, slightly scaly, extensively creeping caudex, producing black fibrous roots. The fronds are hairy, deli-



[*Polypodium Phegopteris*.]

cate in texture, and pale green ; they are produced in May, and are developed with rapidity, reaching maturity in July, and becoming destroyed by the earliest frosts ; they

are lateral, and are not articulated with the caudex. The stipes is succulent, much longer than the frond, very brittle, erect, with a few scattered light-coloured scales near the base. The fronds are pinnate, ovate-triangular, tapering to an acute point, and varying in size from four to ten, twelve, or even twenty inches in length. The pinnæ are narrowly-lanceolate, acute, usually opposite, but sometimes alternate; the lowest pair is bent downwards, placed at a marked distance from the others, and very shortly stalked; the next pair is more or less adnate at the base, and the remainder are united to the rachis by their whole width. When the pinnæ are opposite, a cruciform figure is formed by the contact of the basal segments. In the upper part of the frond, the decurrent bases of the pinnæ are continuous along the rachis. The pinnæ are deeply pinnatifid, those near the apex becoming entire; the point of the frond being altogether pinnatifid. The venation of the ultimate lobes consists of a distinct but slender mid-vein, scarcely thicker than the venules, which are alternate, mostly unbranched, and extending to the margin, those near the base of the segments bearing each a small sorus near their extremity. The sori, which are circular, thus become almost marginal.

This species, though somewhat limited in its distribution, is common in some localities, occurring in moist mountainous situations, in damp woods, and in the vicinity of waterfalls, and seems to be constantly found in damp situations. It occurs in the southern, western, and northern districts of England; in Wales; rather generally in Scotland, and rarely in Ireland. The species is also distributed throughout Europe, and occurs in North America. Fee calls this plant *Phegopteris polypodioides*.

This is a free-growing plant, requiring a very abundant supply of moisture, both about its roots and fronds; the soil, however, should be well drained, that this moisture may not become stagnant. It attains its fullest perfection in damp woods, and near water-falls, even within range of the spray; and hence requires shade and a moist atmo-

sphere to secure the most perfect growth under artificial circumstances. If planted on artificial rockwork, it should be placed where these conditions may be secured, and where it will also enjoy shelter in other respects. As a pot plant, it is a very delicate object; and should be planted in well-drained pots of turfy peat soil, mixed with decayed tree leaves, broken sandstone, and sand. In the summer it succeeds best in a cold frame, shaded from bright sunshine; and it may be induced to grow in winter, by the application of heat, which it bears well. The spray of a waterfall, in which the plant delights, may be imitated, by suspending over the plants a vessel of water, which, furnished with a coarse worsted-thread syphon, may be made to supply a succession of water-drops, to fall on a stone near the plant, and thus keep it constantly sprinkled. It may be increased by separating its creeping caudex.

3. **Polypodium alpestre**, *Sprengel*.—Alpine Polypody. — Fronds bipinnate, lanceolate; pinnules linear-lanceolate, pinnatifid with obtuse sharply serrate lobes.

POLYPODIUM ALPESTRE, Sprengel.—P. RHÆTICUM, Wood's Tour. Fl. 423, not of Linnæus.—ASPIDIUM ALPESTRE, Hoppe: Schkuhr 58, t. 60.—A. RHÆTICUM, Swartz.—PSEUDATHYRIUM ALPESTRE, Newm. App. xlv.

The Alpine Polypody has a short decumbent caudex, having a tendency to become divided into several crowns or distinct axes of growth, to which the adherent fronds are terminal. These fronds, as in most of the deciduous species, grow up about May, and reach their maturity towards the end of summer. The stipes is short, usually about one-sixth of the whole length of the fronds; stoutish, swollen near the very base, and sparingly clothed with a few broadly ovate-lanceolate pointed pallid scales. The fronds vary from six inches to three feet and upwards in height, the more usual height being about a foot and a half; in the former dwarfed condition Mr. Backhouse



[*Polypodium alpestre*.]

describes it as resembling *Cystopteris fragilis*, but in all the more vigorous states it has much of the habit and aspect of *Athyrium Filix-fœmina*, on which account it has been so long overlooked in the Scottish highlands. In outline the fronds are narrow-lanceolate, the base being narrowed about equally with the apex; they are bipinnate, the pinnæ linear-lanceolate acuminate spreading at an obtuse angle with the stout rachis, and rather thickly set with oblong acute very shortly stalked pinnules, which stand at nearly a right angle with the rachis of the pinnæ, and are themselves deeply pinnatifid, the segments being notched with sharp coarse teeth. The venation is very distinct, and consists of a tortuous mid-vein to each pinnule; this throwing off into each segment a pinnate branch, or venule, whose ramifications, the veinlets, are simple, and extend almost to the margin, bearing a sorus some distance below their apex. Either the lowest anterior veinlet only bears a sorus, this occurring in the smaller pinnules, and the sori, then occupying a position just within the sinus of the lobe, form a single series on each side the mid-vein; or, in the larger pinnules, two or more of the lower pairs of veinlets in each segment bear each a sorus, about four being the average number on each lobe: in this latter case the fructification soon becomes confluent, but the sori are at first quite distinct, small, and circular.

This fern, which inhabits the Alps of Europe, has lately been recognised as a common inhabitant of the highlands of Scotland, where it had heretofore been passed over as *Athyrium Filix-fœmina*. It was first found by H. C. Watson, Esq., in 1841, but not then recognised. According to Mr. Backhouse, it occurs in company with the *Athyrium* at from 2,000 to 3,000 feet elevation; above which, at from 3,000 to 4,000 feet, the latter disappears, and *P. alpestre* becomes abundant.

It is perfectly hardy and not inelegant, though not comparable for delicacy with some states of the Lady fern. In the hardy rockery, or in pots, it will grow readily in any

well-drained porous loamy soil; and may be increased by dividing the tufted caudex.

4. **Polypodium Dryopteris**, *Linnaeus*.—Smooth three-branched Polypody, or Oak fern.—Fronds ternate, glabrous, membranaceous, branches pinnate; pinnæ pinatifid, with obtuse subcrenate lobes.

POLYPODIUM DRYOPTERIS, *Linnaeus*: Eng. Bot. 616: Sm. Eng. Fl. iv. 269: Hook and Arn. B. Fl. 567: Bab. Man. 409: Florig. Brit. iv. 42: Newm. 123: Franc. 24.—LASTREA DRYOPTERIS, Newm.—POLYSTICHUM DRYOPTERIS, Roth.—GYMNOCARPIUM DRYOPTERIS, Newm. App. xxiv.—PHEGOPTERIS DRYOPTERIS, Fee.



[*Polypodium Dryopteris*.]

The Smooth three-branched Polypody has a dark-coloured, widely creeping slender caudex, often forming a

dense matted mass ; it is slightly scaly, and protrudes black fibrous roots. The fronds grow up in March and April, soon arriving at maturity, and entirely perishing before winter. Their veneration is peculiar ; the branches are rolled up separately, so that the undeveloped fronds resemble three little balls set on slender wires. They are bright green, smooth, and delicate in texture ; from six to twelve inches high, including the stipes ; three-branched, each branch being triangular, and attached by a distinct stalk-like portion of the rachis, to the common stem or stipes. The stipes is usually two-thirds of the height of the frond ; slender, brittle, dark-coloured, and quite smooth, except in having a few scattered scales near the base ; it is lateral and adherent to the caudex. The central branch of the frond is the largest, and its rachis is deflexed ; the others stand at an obtuse angle ; thus all the branches become loosely spreading. Each branch is pinnate at the base, and pinnatifid at the apex ; the pinnæ usually opposite, and, especially in the central branch, themselves pinnate at the base, then pinnatifid, and acute and nearly entire at the apex. The pair of pinnules at the base of each pinna are so placed, that when the pinnæ are exactly opposite, and they are thus brought together, they stand somewhat in the form of a cross, the two towards the apex of the branch being nearly parallel, and smaller than the other two which are divergent. The pinnules and ultimate lobes are oblong and obtuse. Sometimes the fronds are more compoundly divided, the pinnules instead of being serrated as in ordinary examples being pinnatifid ; when this is so, the venation becomes more developed. In ordinary cases, each pinnule, or ultimate lobe, has a slender tortuous mid-vein, from which venules branch out alternately, extending quite to the margin, and bearing the sori, near their extremity ; when the parts are more compound in structure, the venules are branched. In some cases the sori are numerous, and form a crowded line near the margin ; in other examples they are few and scattered.

This species is almost entirely confined to wild and mountainous rocky districts, occurring in the drier parts of wet woods, and in the neighbourhood of waterfalls, sometimes growing on limestone in company with *P. Robertianum*. It is met with in various parts of England, Wales, and Scotland, but is very rare in Ireland. It occurs also throughout Europe, Northern Asia, and North America.

This species is a moisture-loving plant, and also a lover of shade and shelter; indeed its delicate texture would render it liable to injury if much exposed. It is, however, an excellent dwarf rock fern, and very hardy. It is a very free-growing pot plant, and may be readily increased by the division of its creeping caudex.

5. *Polypodium Robertianum*, Hoffman.—Limestone Polypody. — Fronds subternate, glandular-mealy, lower branches bipinnate at the base; pinnæ pinnatifid with obtuse lobes.

POLYPODIUM ROBERTIANUM, Hoffmann.—P. CALCAREUM, Smith, Fl. Brit. 1117: Eng. Fl. iv. 270: Eng. Bot. 1525: Hook and Arn. Fl. 567: Bab. Man. 409: Florig. Brit. iv. 43: Newm. 131: Franc. 24.—LASTREA ROBERTIANA, Newman.—L. CALCAREA, Newm.—GYMNOCARPIUM ROBERTIANUM, Newm. App. xxiv.—PHEGopteris CALCAREA, Fee.

The Limestone Polypody has a dark brown creeping caudex, rather stouter than that of *P. Dryopteris*. The fronds grow up in May, and attain full development soon after Midsummer. They are deep dull green, firm and subrigid in texture, six to twelve or eighteen inches in height, erect, and without the marked deflexure of the rachis observable in *P. Dryopteris*. In veneration their pinnæ are rolled up separately into little balls. The stipes is stoutish, pale-coloured, much longer than the frond, abundantly scaly about the base, and clothed with very minute stalked glands which occur more or less over the whole frond, giving it a dull mealy aspect, which character forms an

GENUS II.

ALLOSORUS, *Bernhardi*.

GEN. CHAR.—*Sori* circular, at length confluent, attached near the apex of the venules, covered by the revolute margin of the pinnules of contracted fertile fronds. *Veins* free, mid-vein distinct, forked where soriferous.

The only British species of this genus is an elegant little plant, somewhat resembling parsley, and assuming two or three distinct forms. The genus has considerable affinity with *Pteris*, from which however the unaltered condition of the indusioid margin, and the detached masses of spore-cases readily distinguish it.

The name is derived from the Greek *allos* (various), and *sorus* (a heap), in allusion to the altered appearances of disposition presented by the sori in the stages of their development.

1. **Allosorus crispus**, *Bernhardi*. — Rock Brakes, or Mountain Parsley.—Fronds of two kinds, bi-tri-pinnate; ultimate divisions of barren fronds wedge-shaped often bifid; of the fertile linear-oblong.

ALLOSORUS CRISPUS, *Bernhardi*: Bab. Man. 408: Florig. Brit iv. 47: Newm. 103.—OSMUNDA CRISPA, Linn.—PTERIS CRISPA, Linn. MS.: Sm. Eng. Fl. iv. 306: Eng. Bot. 1160. — CRYPTOGRAMMA CRISPA, R. Br.: Hook and Arn. Fl. 575: Franc. 57.—PHOROLOBUS CRISPUS, Desv.

The Rock Brakes has a short decumbent caudex, producing numerous fibrous roots, and a tuft of adherent fronds from its crown. The young fronds spring up in May and June, and attain maturity by the end of the summer, disappearing at the commencement of winter. They are nearly triangular in outline, and from four to eight and sometimes twelve inches high. The stipes is long, slender, pale-coloured, and smooth. The barren fronds are bi-tri-pinnate, the pinnæ



[*Allosorus crispus*.]

pinnules and lobes being all alternate; the ultimate divisions are wedge-shaped and cleft, or oblong-oval with an even sinuously-toothed margin; or sometimes

GENUS III.

GYMNOGRAMMA, Desvauz.

GEN. CHAR.—*Sori* linear forked, subsequently confluent; *spore-cases* medial, superficial on the back of the veins. *Veins* free, forked or pinnate.

This genus consists principally of tropical ferns, and includes those beautiful species whose fronds, covered beneath with a golden or silvery powder, are familiarly called Gold and Silver Ferns.

The name is derived from *gymnos* (naked), and *gramme* (a line); and alludes to the circumstance of the sori being linear and naked.

1. **Gymnogramma leptophylla, Desvauz.** — Slender Gymnogram.—Fronds ovate bipinnate, fragile; pinnæ roundish cuneate, about three-lobed, the lobes obtuse two-toothed.

GYMNOGRAMMA LEPTOPHYLLA, Desvauz.—ANOGRAMMA LEPTOPHYLLA, Link.—GRAMMITIS LEPTOPHYLLA, Swartz.—POLYPODIUM LEPTOPHYLLUM, Linnæus.—ACROSTICHUM, LEPTOPHYLLUM, De Candolle.—OSMUNDA LEPTOPHYLLA, Lamarck.—ASPLENIUM LEPTOPHYLLUM, Cavanilles.

The Slender Gymnogram is an annual or perhaps a biennial species. The plants form each a little crown, fixed to the soil by a few short fibres, and producing a



[*Gymnogramma leptophylla*].

GENUS IV.

WOODSIA, R. Brown.

GEN. CHAR.—*Sori* circular, attached near the extremity of the venules. *Indusium* divided at the margin into numerous incurved capillary jointed segments, inferior and therefore involucrel. *Veins* free; mid-vein indistinct; venules simple or forked.

There are two native species of this genus, the obvious and constant differences between which are altogether opposed to any doubt of their specific distinctness; the plants being in every stage of development altogether different.

The name has been given in compliment to J. Woods, Esq., a writer on British Roses, and author of the *Tourist's Flora*.

1. **Woodsia ilvensis, R. Brown.**—Oblong Woodsia.—Fronds pinnate lanceolate, covered with narrow chaffy hair-like scales beneath; pinnæ oblong deeply pinnatifid, with bluntly ovate or oblong obtuse lobes; stipes and rachis chaffy.

WOODSIA ILVENSIS, R. Brown: Eng. Bot. Sup. 2616: Sm. Eng. Fl. iv. 309. Hook and Arn. Fl. 567: Bab Man. 409: Florig. Brit. iv. 45: Newm. 137: Franc. 26.—ACROSTICHUM ILVENSE, Linnæus.—POLYPODIUM ILVENSE, Swartz.

The Oblong *Woodsia* has a thick tufted caudex, from which the wiry roots are produced. The deciduous fronds, which are pinnate and broadly lanceolate, vary from two to six, but seldom exceed four inches in height. They are somewhat thick, appearing smooth above when mature, but in reality sparingly clothed with bristle-like scales, which, together with shining jointed hairs, are much more abundant on the veins beneath, and are also numerous on the stipes and rachis. The stipes is distinctly articulated or jointed at a short distance from its junction with the caudex to which it is adherent, and it is at this point the natural separation of the frond takes place, the basal portion remaining attached to the caudex, and the upper portion falling away. This articulation of the stipes is a character common to a section of the genus. The pinnae are usually opposite, oblong obtuse, broadest at the base, sessile, deeply lobed or pinnatifid with many ovate-oblong obscurely crenated segments. The mid-vein of these ultimate divisions is indistinct, the venules free, sometimes branched and sometimes simple, extending nearly to the margin, in which position the sori are produced, thus forming a marginal series. The sori are circular and quite distinct in the young state, but become at length more or less confluent; and are often almost concealed by the hair-scales already mentioned, and by the capillary segments of their involucre.

[*Woodsia ilvensis*.]

This covering consists, first, of very long pointed narrow scales which are more particularly abundant about the mid-rib; secondly, of jointed shining hairs, which are scattered nearly over the whole surface; and thirdly of the capillary segments of the involucre themselves, which are also jointed and shining. The fronds die down on the approach of frost, and are renewed in spring.

This is one of the rarest of our indigenous species, growing in exposed rocky alpine regions, and there very sparingly. The Falcon Clints and Cauldron Spout, in Teesdale, Durham; Clogwynn-y-Garnedd, one of the highest peaks of Snowdon, and Llynny-cwn, on Glyder Vawr, in Wales; and Moffat, Dumfries; Ben Chonzie, Ben Lawers, and the Clova Mountains in Scotland, are the chief recorded localities. In these places it grows sparingly, rooting into the crevices of the damp rocks. It occurs in the most northern parts of the northern hemisphere, as far as Greenland.



[*Woodsia hyperborea*.]

2. ***Woodsia hyperborea*, R. Brown.** — Alpine Woodsia. — Fronds pinnate linear-lanceolate; pinnæ bluntly triangular, pinnatifid with rounded usually entire lobes.

WOODSIA HYPERBOREA, R. Brown: Eng. Bot. 2023: Sm. Eng. Fl. iv. 310: Hook and Arn. Fl. 567: Franc. 27.—W. ILVENSIS, *vars.*, Bab. Man. 409.—W. ALPINA, Newm. 143: Florigr. Brit. iv. 46.—ACROSTICHUM ALPINUM, Bolton.—A. HYPERBOREUM, Liljeblad.—POLYPODIUM HYPERBOREUM, Swartz.—P. ARVONICUM, Withering: Sm. Fl. Brit. 1115.

Two forms of this species are distinguished by Mr. Babington — *gracilis* with linear-lanceolate fronds, triangular pinnatifid pinnae, cut into 5–9 obtuse lobes, which are entire, or the lowest one crenate (*Woodsia hyperborea*, Eng. Bot.; *Polypodium hyperboreum* β *gracile*, Wahl.); and *alpina* having oblong fronds, triangular oval pinnae, with 3–5 rounded very blunt lobes (*W. alpina*, Newm.; *Polypodium hyperboreum*, Wahl.; *Acrostichum, alpinum*, Bolt).

The Alpine Woodsia has a thick tufted caudex, from which are protruded the blackish wiry roots. The fronds which die down annually, growing up again in spring, are narrow, almost linear, pinnate; more tender and membranous than *W. ilvense*; glabrous, or nearly so, though sometimes the stipes, rachis, and veins beneath bearsome scattered hairs, mixed with a few pale chaffy scales, which are chiefly present in the young state, and apparently very easily displaced. The stipes is articulated as in the last species, the lower part remaining adherent to the tufted caudex. The pinnae are trian-



[*Woodsia alpina*.]

tuft of about half a dozen fronds, which vary much in their size and division, and are of a delicately membranous texture. When the plants have reached maturity there are usually present, first, a very small fan-shaped frond, half an inch high, divided into two or three lobes, and probably the first developed from the primordial scale. Then one or two pinnate fronds, one or two inches long, and having obliquely fan-shaped three-lobed pinnæ, more or less tapering to the base and decurrent with the rachis. Both these forms of frond are spreading, more leafy than the rest of the plant, and usually barren. The plants reach their full development by producing two or three larger, more erect, and more compound fertile fronds, which vary from three or four to six or eight inches in height; of these the stipes is stoutish, glossy, light brown, and about half the entire length; the frond is ovate twice or three-times pinnate, the pinnæ alternate ovate, with alternate pinnules. The ultimate pinnules are three-lobed at the apex and wedge-shaped at the base, and hence become roundish-cuneate, the lobe being rather distinct, and usually slightly and bluntly notched at the apex, so as to become two-toothed; the little stalk of the pinnules is somewhat decurrent with the rachis. The venation is very simple: a vein breaks off from the rachis into each pinnule, and branches twice so as to send a venule into each lobe, the venules usually becoming forked, and one veinlet proceeding nearly to the apex of each of the little teeth into which the lobe is divided; the spore cases are borne along the whole length of the veinlets and on a portion of the venule, so that the sori form two lines on each lobe of the pinnule diverging from their base where they are united. Occasionally the lobe is not toothed, and there is but a simple venule and one line of spore-cases. The sori at length become confluent, and cover the under surface of the pinnules.

This interesting little fern has long been known as native of Madeira and the Azores, extending through Portugal and Spain northwards to France. It is further

stated by Link to occur in Naples, Sicily, and the Morea; and, according to Kunze, it is also indigenous to Mexico. It was found in Jersey in 1852, and thus becomes added to the list of British species. It had also, during the same year, been reported to have been found indigenous near Braemar, in Aberdeenshire; but this is so unlikely a range for a southern plant that some error is to be suspected.

This fern is properly a greenhouse or half-hardy species, requiring a moist, calm atmosphere, and a shady situation, such as a close frame facing the north. It will, however, readily accommodate itself to a much higher temperature, and may be cultivated with good success in a hothouse, where, in company with its near ally *G. chærophylla*, a West Indian species, it will scatter its spores, and come up annually, if any suitable situation in the house is left undisturbed. Very light sandy peat soil is the best for it, and if grown in pots several plants should be associated in the same pot. Its small size, quick as well as free growth, and delicate structure, will render it both suitable and interesting for a Wardian Case.

GENUS IV.

WOODSIA, *R. Brown.*

GEN. CHAR.—*Sori* circular, attached near the extremity of the venules. *Indusium* divided at the margin into numerous incurved capillary jointed segments, inferior and therefore involucrel. *Veins* free; mid-vein indistinct; venules simple or forked.

There are two native species of this genus, the obvious and constant differences between which are altogether opposed to any doubt of their specific distinctness; the plants being in every stage of development altogether different.

The name has been given in compliment to J. Woods, Esq., a writer on British Roses, and author of the *Tourist's Flora*.

1. **Woodsia ilvensis**, *R. Brown.*—Oblong *Woodsia*.—Fronds pinnate lanceolate, covered with narrow chaffy hair-like scales beneath; pinnæ oblong deeply pinnatifid, with bluntly ovate or oblong obtuse lobes; stipes and rachis chaffy.

WOODSIA ILVENSIS, *R. Brown*: Eng. Bot. Sup. 2616: Sm. Eng. Fl. iv. 309. Hook and Arn. Fl. 567: Bab Man. 409: Florig. Brit. iv. 45: Newm. 137: Franc. 26.—**ACROSTICHUM ILVENSE**, *Linnaeus*.—**POLYPODIUM ILVENSE**, *Swartz*.

The Oblong Woodsia has a thick tufted caudex, from which the wiry roots are produced. The deciduous fronds, which are pinnate and broadly lanceolate, vary from two to six, but seldom exceed four inches in height. They are somewhat thick, appearing smooth above when mature, but in reality sparingly clothed with bristle-like scales, which, together with shining jointed hairs, are much more abundant on the veins beneath, and are also numerous on the stipes and rachis. The stipes is distinctly articulated or jointed at a short distance from its junction with the caudex to which it is adherent, and it is at this point the natural separation of the frond takes place, the basal portion remaining attached to the caudex, and the upper portion falling away. This articulation of the stipes is a character common to a section of the genus. The pinnae are usually opposite, oblong obtuse, broadest at the base, sessile, deeply lobed or pinnatifid with many ovate-oblong obscurely crenated segments. The mid-vein of these ultimate divisions is indistinct, the venules free, sometimes branched and sometimes simple, extending nearly to the margin, in which position the sori are produced, thus forming a marginal series. The sori are circular and quite distinct in the young state, but become at length more or less confluent; and are often almost concealed by the hair-scales already mentioned, and by the capillary segments of their involucre.



[Woodsia ilvensis.]

This covering consists, first, of very long pointed narrow scales which are more particularly abundant about the mid-rib; secondly, of jointed shining hairs, which are scattered nearly over the whole surface; and thirdly of the capillary segments of the involucre themselves, which are also jointed and shining. The fronds die down on the approach of frost, and are renewed in spring.

This is one of the rarest of our indigenous species, growing in exposed rocky alpine regions, and there very sparingly. The Falcon Clints and Cauldron Spout, in Teesdale, Durham; Clogwynn-y-Garnedd, one of the highest peaks of Snowdon, and Llynny-cwn, on Glyder Vawr, in Wales; and Moffat, Dumfries; Ben Chonzie, Ben Lawers, and the Clova Mountains in Scotland, are the chief recorded localities. In these places it grows sparingly, rooting into the crevices of the damp rocks. It occurs in the most northern parts of the northern hemisphere, as far as Greenland.



[*Woodsia hyperborea*.]

2 ***Woodsia hyperborea*, R. Brown.** — Alpine Woodsia. — Fronds pinnate linear-lanceolate; pinnæ bluntly triangular, pinnatifid with rounded usually entire lobes.

WOODSIA HYPERBOREA, R. Brown: Eng. Bot. 2023: Sm. Eng. Fl. iv. 310: Hook and Arn. Fl. 567: Franc. 27.—*W. ILVENSIS*, *vars.*, Bab. Man. 409.—*W. ALPINA*, Newm. 143: Florigr. Brit. iv. 46.—*ACROSTICHUM ALPINUM*, Bolton.—*A. HYPERBOREUM*, Liljeblad.—*POLYPODIUM HYPERBOREUM*, Swartz.—*P. ARVONICUM*, Withering: Sm. Fl. Brit. 1115.

Two forms of this species are distinguished by Mr. Babington — *gracilis* with linear-lanceolate fronds, triangular pinnatifid pinnæ, cut into 5–9 obtuse lobes, which are entire, or the lowest one crenate (*Woodsia hyperborea*, Eng. Bot.; *Polypodium hyperboreum* β *gracile*, Wahl.); and *alpina* having oblong fronds, triangular oval pinnæ, with 3–5 rounded very blunt lobes (*W. alpina*, Newm.; *Polypodium hyperboreum*, Wahl.; *Acrostichum, alpinum*, Bolt).

The Alpine Woodsia has a thick tufted caudex, from which are protruded the blackish wiry roots. The fronds which die down annually, growing up again in spring, are narrow, almost linear, pinnate; more tender and membranous than *W. ilvense*; glabrous, or nearly so, though sometimes the stipes, rachis, and veins beneath bear some scattered hairs, mixed with a few pale chaffy scales, which are chiefly present in the young state, and apparently very easily displaced. The stipes is articulated as in the last species, the lower part remaining adherent to the tufted caudex. The pinnæ are trian-



[*Woodsia alpina*.]

gular with the angles rounded, less deeply pinnatifid than in *W. ilvense*; the lobes, 3—7 in number, are broadly ovate and entire, the first superior lobe sometimes considerably larger than the rest. The pinnæ are usually alternate, the lower ones distant, and gradually becoming smaller from near the middle. The midvein of the pinna is indistinct, its venules free, simple or forked, extending almost to the margin. The sori are placed near the extremity of the veins, and in consequence of the presence of more numerous spore-cases are larger than in *W. ilvensis*, and often become confluent.

This is equally rare with its kindred species, and has been discovered only in the wildest and most inaccessible mountain regions. It has been found on Clogwynn-y-Garnedd, Snowdon, in Wales; and on Ben Chonzie, Ben Lawers, Craig-Challiach, Mael-dun-Crosk, and the Clova mountains in Scotland. It is also met with rarely in arctic and sub-arctic countries.

The Woodsias are best cultivated in moderate-sized well-drained pots, kept in a cold frame, facing the north in the summer season, and should not be kept constantly closed up. They are very impatient of sunshine and stagnant moisture. The crown of the plants may in potting be advantageously elevated a little between three small pieces of freestone. They must not be kept too damp, especially during winter. A shady shelf in a cool greenhouse, where there is a free circulation of air or a dryish cold frame are good situations in which to preserve them during the dormant season. When it becomes necessary to divide the tufts, which is the most ready mode of propagation, it should be done very carefully in spring about the time they commence their seasonal growth. In obtaining plants from their wild habitats for the purpose of cultivation, as with most other of the rare ferns, it is found that small plants are much more successfully transplanted than the large and older masses.

GENUS V.

CYSTOPTERIS, *Bernhardi*.

BLADDER FERN.

GEN. CHAR.—*Sori* roundish, small, medial, attached at the back of the venules. *Indusium* hooded or cucullate, fixed by its broad base beneath the sori (which it covers when young), the free margin fringed, and directed towards the apex of the segment, at length reflected. *Veins* free; midvein distinct, sinuous; venules simple.

The Bladder ferns are all very elegant plants, with much divided fronds, of delicate texture; and easily cultivated.

The name is derived from the Greek *kystos*, a bladder, and *pteris*, a fern; in allusion to the peculiar form of the indusium.

1. ***Cystopteris fragilis, Bernhardi*.** — Brittle Bladder-fern.—Fronds lanceolate bipinnate: pinnae ovate-lanceolate, or oblong-lanceolate; pinnules ovate, or ovate-lanceolate, pinnatifid or toothed. The following are distinguishable, though closely connected forms:—

a. vulgaris: fronds lanceolate; “pinnules ovate-acute pinnatifid, cut, or serrated;” sori sub-central, becoming confluent.

[*Cystopteris fragilis*.]

CYSTOPTERIS FRAGILIS, Bernhards: Hook and Arn. 572: Bab. Man. 412: Florig. Brit. iv. 85: Newm. 155: Franc. 29.—C. FRAGILIS *a*, Hook. Sp. Fil. i. 197.—CYATHEA FRAGILIS, Sm. Fl. Brit. 1139: Eng. Bot. 1587.—CYATHEA CYNAPIFOLIA, Roth.—CYATHEA ANTHRISCIFOLIA, Roth.—CYSTEA FRAGILIS, Sm. Eng. Fl. iv. 285.—POLYPODIUM FRAGILE, Linnæus.—P. CYNAPIFOLIUM, Hoffm.—P. ANTHRISCIFOLIUM, Hoffm.—P. POLYMORPHUM, Villars.—P. TRIFIDUM, Withering.—ASPIDIUM FRAGILE, Swartz.

β. angustata: fronds oblong-ovate; “pinnules linear-lanceolate, deeply and acutely pinnatifid, or slightly toothed on the margin;” ultimate subdivisions oblong or linear; sori distinct, sub-central.

CYSTOPTERIS FRAGILIS, *β* Franc. 30.—C. DENTATA, *β* Hook. Brit. Fl. 5 ed. 441.—CYATHEA FRAGILIS, *β* and *γ* Sm. Fl. Brit. 1139.—CYSTEA ANGUSTATA, Sm. Eng. Fl. iv. 288.

γ. dentata: fronds oblong-lanceolate; “pinnules ovate-obtuse, bluntly toothed, rarely pinnatifid;” sori sub-marginal, often crowded, sometimes confluent.

CYSTOPTERIS DENTATA, Hook. Brit. Fl. 5 ed. 441. Franc. 28.—CYATHEA DENTATA, Sm. Fl. Brit. 1141.—CYSTEA DENTATA, Sm. Eng. Fl. iv. 287: Eng. Bot. 1588.—POLYPODIUM DENTATUM, Dickson.—ASPIDIUM DENTATUM, Swartz.

δ. Dickieana: fronds ovate-lanceolate; pinnæ deflexed, overlapping; pinnules crowded, broad obtuse, very slightly toothed; sori marginal, distinct.

CYSTOPTERIS DICKIEANA, Sim. Gard. Journ. (1848) 308: Newm. App. xxvi.—C. FRAGILIS, *var. DICKIEANA*, Moore, in 1 ed. p. 81, and Bot. Gaz. i. 310.

The Brittle Bladder-fern is an exceedingly variable plant, assuming several tolerably distinct forms; but these are so closely connected by intermediate states, as hardly to admit of definition. Indeed it is possible to obtain from

the same root at different periods, fronds resembling each of the forms above enumerated. The species has a short creeping or quasi-tufted caudex, producing numerous wiry roots. The fronds, which are very delicate in every state, are terminal, and adherent to the caudex; they grow up early in the spring, and die down annually, soon arriving at maturity, and as speedily declining, a succession of fronds being produced throughout the summer and autumn, but disappearing with the first frosts of winter. The stipes is



[*Cystopteris angustata*.]

smooth, of a brown or blackish colour, very brittle, from about one-third to one-half the height of the frond, destitute of scales, excepting a few small ones at the base; in the upper part it is usually slightly bordered or winged. The fronds are bipinnate, and they grow up several together more or less erect. The general form is lanceolate, and the size very variable—from three or four to twelve or fifteen inches in height. The pinnae are lanceolate, with the pinnules distinct, ovate acute or pointed, tapering at the base, and copiously deeply and sharply toothed on the margin; the larger and lower ones

being deeply pinnatifid, their lobes resembling the upper pinnules. The texture is very delicate: from this cause, the venation is distinctly seen. The mid-vein of each pinnule is more or less sinuous or flexuose; from this the venules are produced alternately, becoming more or less branched. In the larger lobes, where the venule becomes a secondary midvein, a series of simple branches are usually produced, each extending to the margin, and generally bearing a sorus towards its extremity; in the smaller lobes the lateral veins become two, three, or four-branched, one branch extending to each of the serratures of the lobe. The sori are usually numerous, one being borne by most of the veins; they are disposed rather nearer the mid-vein, than the margin, and are at first distinct though they often become confluent afterwards and cover the whole under surface. They are of small size and nearly circular, covered by a pale membranous concave or hood-shaped indusium, which is attached by its broad base beneath the capsules on the side towards the base of the lobe, the other extremity, or that towards the apex of the lobe, becoming free, and at this part usually split, jagged, or torn into narrow unequal often capillary segments. This indusium soon becomes reflected, and is at length obliterated, or pushed off by the growing spore cases.

The variety *angustata* is one of the larger forms of the species, growing from six to fifteen inches high. It differs from the commoner variety in the more ovate outline of the frond, which is much attenuated and lengthened at the apex; in having its pinnæ lanceolate with the point much narrowed and extended; and in its pinnules being linear-lanceolate, deeply and acutely pinnatifid, or slightly toothed at the margin, the ultimate divisions being always oblong or linear and acute, never dilated rounded or ovate. The sori too are smaller and less prominent, and always continue distinct, standing either solitary, or in pairs, towards the bottom of each lobe or tooth, and thus occupying a sub-central position. This variety does not appear to be very common.

The variety *dentata* is smaller, and grows from six to eight inches in height; the pinnae are of an ovate-lanceolate form, and in the young fronds take a reflexed drooping convex habit; the pinnules are distinct, oblong or oblong-ovate, obtuse, pointless, deeply and bluntly toothed, or, in luxuriant specimens, a few of the lowest become pinnatifid. The sori also are sub-marginal, and often numerous. This form would seem to be not uncommon, if the records concerning it are trustworthy; but it is to be feared that this is not the case. It seems to be more common in the north and in Scotland, and is scarcely recorded from Ireland.

The variety *Dickieana* is of the average height of four to six inches. The fronds of this plant are often scarcely bipinnate, the pinnae and upper pinnules being frequently confluent. The pinnae are ovate-lanceolate, somewhat twisted round, so that one edge points backwards, and the other forwards, as occurs in an equally marked way in *Polystichum Lonchitis*; they are also deflexed more or less. The pinnules are mostly somewhat decurrent, and sometimes much so, broad, oblong or oblong-ovate, obtuse, having but a few shallow blunt notches on the margin, and lying over each other in an imbricate manner. The sori are less numerous than in *dentata*, and are ranged close to the margin, often just within the sinus of the shallow lobes. It is the most



[*Cystopteris dentata*.]

distinct and least divided British form of Bladder-fern. Found only in a cave near the sea at Aberdeen, where it was met with in 1846, by Dr. Dickie, to whom I am indebted for the only native specimens I have seen. It is now

common in cultivation, having been distributed liberally by Dr. Dickie, and is found to retain all its peculiarities, and to reproduce itself from the spores.

Though I have placed all the above forms as varieties of *C. fragilis*, I am inclined to think *C. dentata* to be sufficiently distinct to take rank as a species, and to look upon *C. Dickieana* as an extreme form of it.

The species is moderately abundant as well as widely distributed throughout the United Kingdom, growing in the fissures of rocks and walls, in moist and mountainous districts showing a preference for limestone, and generally finest in the vicinity of



[*Cystopteris Dickieana*.]

waterfalls. It is apparently more rare in Ireland, though Mr. Newman found it in great profusion near Sligo, occurring not only on the limestone rocks and walls, but also in the hedge-rows, mingled with *Scolopendrium vulgare*. The same species (or what is considered to be such) is generally distributed throughout Europe, and in Asia, Africa, and North America, as well as the Islands of the Pacific.

From the delicate texture of this fern, and its adaptability to various situations, it is well suited for cultivation; and grows vigorously planted either on rockwork or in pots, and placed either within a frame or without one in a sheltered and shady position; it however becomes most beautiful when developed in the damp close atmosphere of a frame or glazed case. The small size of the plant renders it more convenient for pot culture than many other kinds. The other species of *Cystopteris* are similar in habit, and may be cultivated in the same manner. The dormant crowns should not be kept too damp during the winter. They all propagate readily by separating the crowns whenever more than one is formed, and most of them form new crowns rapidly.

2. *Cystopteris alpina*, Desvaux.—Alpine Bladder-fern.—Fronds lanceolate sub-tripinnate; pinnae ovate: pinnules ovate-oblong confluent deeply pinnatifid, the lobes broadly and shortly linear with two or three erect blunt teeth; rachis winged.

CYSTOPTERIS ALPINA, Desvaux: Hook. and Arn. 572: Hook. Sp. Fil. i. 199: Bab. Man. 412: Franc. 30.—C. REGIA, Presl.—C. FRAGILIS, ♂ Newm. 157.—CYATHEA REGIA, Forster.—CYATHEA INCISA, Sm. Eng. Bot. 163.—CYSTEA REGIA, Sm. Eng. Fl. iv. 289, in part.—POLYPODIUM ALPINUM, Jacquin.—POLYPODIUM REGIUM, Linn.—ASPIDIUM REGIUM, Swartz.

The Alpine Bladder-fern is an extremely elegant little plant, with fronds more deeply divided than in *C. fragilis*,

and having their pinnules and segments much more closely and compactly arranged than in that species. It has a short tufted caudex, from which the fibrous roots are pro-



[*Cystopteris alpina*.]

truded, and to which the fronds are terminal and adherent. The fronds, usually produced in May and dying down early in autumn, are numerous, bright green, erect, lanceolate, and vary from four to eight or ten inches in height. They are bipinnate, some of the pinnules being so deeply pinnatifid as to appear almost again pinnate; they are, however, scarcely tripinnate, the lobes of the pinnules being, I believe, in almost all cases, decurrent. The stipes is usually short, not so brittle as in *fragilis*, and smooth except immediately at the base, where it is surrounded by a few pointed brown scales. The pinnae are ovate, divided into bluntly-ovate pinnules which are distinctly stalked and deeply cleft, almost down to the midvein, into short blunt linear lobes, which are sometimes entire, and sometimes have two or three erect blunt teeth; these lobes being distinctly decurrent at the base, the pinnules are pinnatifid, and not pinnate, although sometimes very nearly so. The venation is very distinct. The mid-vein of the pinnae, which forms the second-

ary rachis, is slightly winged. The mid-vein of the pinnules is almost straight; from this a venule branches off to each lobe, and these venules are either simply forked or, according to the size of the pinnule, have three or four alternate branches, one branch extending to the point of

each marginal tooth. The sori are borne towards the margin, and are often numerous but not crowded, and I believe never confluent; they are small and roundish, with a white membranous concave indusium attached by its base towards the base of the lobes, having a free more or less jagged point.

This species has now but slight claims to be regarded as a British fern; its only authenticated habitat is a wall at Low Layton, in Essex, where it was originally found, near the close of the last century, in great plenty, by Mr. Forster. Repairs of the wall have, however, nearly eradicated the plant, though it has within the last few years been found there and in the neighbourhood sparingly. Mr. Shepherd, of Liverpool, has sent me specimens of *C. alpina*, said to have been gathered in Derbyshire and Yorkshire, but without assigning more particular habitats. Scotch and Welsh alpine stations which have been assigned to this species probably belong to some of the small much-divided forms of *C. fragilis*. *C. alpina* is distributed over the Alps of Europe, chiefly in the south.

It may be cultivated precisely in the same manner as *Cystopteris fragilis*.

3. *Cystopteris montana*, Link.—Mountain Bladder-fern.—Fronds triangular tripinnate; pinnae spreading ultimate pinnules narrow oblong or obtusely sub-falcate inciso-dentate or pinnatifid, the lobes toothed at the apex rachis not winged.

CYSTOPTERIS MONTANA, Link: Hook. Sp. Fil. i. 200: Hook. and Arn. Fl. 572: Florig. Brit. iv. 88: Newm. 159: Bab. Man. 413.—CYSTOPTERIS ALLIONI, Newm. App. xxv.—POLYPODIUM MONTANUM, Allionl.—CYATHEA MONTANA, Roth.—ASPIDIUM MONTANUM, Swartz.

The Mountain Bladder-fern is well distinguished by its small triangular fronds, which in shape resemble those of *Polypodium Dryopteris*. It has a long creeping filiform scaly caudex, to which the fronds are either terminally or laterally adherent. The stipes is long, slender, erect, red-

brown, slightly scaly near the base. The frond is triangular, tripinnate in the pinnules of the lower pinnae, bipinnate in the rest of the frond; both the pinnae and



[*Cystopteris montana*.]

pinnules being spreading. The first pair of pinnae are nearly opposite, and very much larger than any of the others often in size nearly equalling all the rest; the second pair are also nearly opposite, but the remainder gradually become alternate. The basal inferior pinnules of the lower pinnae are very much larger and more divided than the superior pinnule of the same pair; this disproportion gradually decreasing until, near the apex of the pinnae, the opposite pinnules nearly correspond in size.

The pinnae being pinnate, the pinnules also pinnate, the lobes deeply pinnatifid, and their divisions notched, it is, though small, one of the most compound of our ferns. The venation is consequently compound. The lateral veins or venules of the larger ultimate divisions become secondary mid-veins producing alternate veinlets, which generally terminate in a sinus between two serratures. The sori are numerous, and become very prominent when mature; nevertheless although crowded, they do not seem to become confluent. The indusium is sub-rotund and very obtuse, attached behind the sorus, bending forward in the manner of a hood towards the point of the lobe, and having its free margin jagged or uneven.

The head-quarters in Britain of this very rare and local fern are the Highlands of Scotland, where it was found, first on Ben Lawers one of the Breadalbane mountains, by Mr. Wilson, in company with Professors Hooker and Graham, in 1836; and subsequently by Messrs. Gourlie, Adamson, Borrer, and Little, and Dr. Walker Arnott in 1841, 1850, and 1851, in a ravine called Corrach Dh' Oufillach, or Corrach Uachdar, between Glen Dochart and Glen Lochay, in the Mhiel Oufillach mountains in Perthshire. It is reported to have been found in North Wales by Plukenet, and we are informed that the existence of the species in Wales has been recently confirmed, though the information is incomplete; it is not, however, improbable, as the species is met with in the Alps of Europe, occurring most frequently in the north, and generally on rough stony ground. It is also a native of the Rocky Mountains of North America.

This is strictly an Alpine plant, and requires treatment similar to that recommended for the other species, with perfect rest in winter.

GENUS VI.

POLYSTICHUM, Schott.

SHIELD FERN.

GEN. CHAR.—*Sori* round, medial. *Indusium* circular, peltate or attached by its centre. *Veins* free; midvein distinct; venules forked or pinnately forked, the lowest anterior one or more fertile.

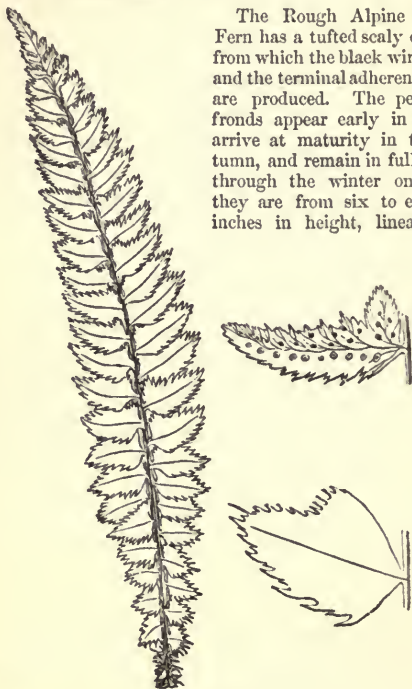
This genus embraces a set of British Ferns, the extremes of which are of very dissimilar appearance, but they are so closely connected by an intermediate series that much difference of opinion prevails as to what should be regarded as distinct. We have adopted a middle course, and believe the arrangement here proposed to be a natural one. This group being the most typical portion of the old genus *Aspidium*, it is proposed to retain for it the English name of Shield Fern given to that genus, adopting its equivalent—Buckler Fern—for the group of *Lastrea*.

The name is derived from the Greek *poly* many, and *stichos* order; in allusion to the numerous regular lines in which the sori are disposed.

1. **Polystichum Lonchitis**, Roth.—Rough Alpine Shield Fern, or Holly Fern.—Fronds linear-lanceolate rigid pinnate, pinnæ spinose-serrate, auricled at the base above and oblique below, not lobed.

POLYSTICHUM LONCHITIS, Roth: Bab. Man. 411: Newm. 163: Florigr. Brit. iv. 89.—*ASPIDIUM LONCHITIS*, Swartz: Sm. Eng. Fl. iv. 271: Hook and Arn. FL 568: Franc. 32.—*POLYPODIUM LONCHITIS*, Linnæus: Eng. Bot. t. 797.

The Rough Alpine Shield Fern has a tufted scaly caudex, from which the black wiry roots, and the terminal adherent fronds are produced. The persistent fronds appear early in spring, arrive at maturity in the autumn, and remain in full vigour through the winter onwards; they are from six to eighteen inches in height, linear lan-



[*Polystichum Lonchitis*.]

ceolate, rigid, and of leathery texture, deep green, and prickly serrate on the margin. The stipes is very short, clothed below the leafy part with large broad taper-pointed, chaffy scales, and with smaller ones above. The fronds are simply pinnate. The pinnæ are short, alternate, extending nearly to the base of the stipes, somewhat crescent-shaped, the base being annicled on the upper side, and sloped or cut away on the lower side, crowded and subimbricate, being twisted so that the upper margin projects behind the next superior pinna. The serratures of the margin are acutely spined. The mid-vein is distinct, and branches into free alternate veins, which are generally three-branched, the anterior venule bearing a sorus, and terminating just beyond it; the other venules sometimes bear sori and reach to the margin. The vein of the enlarged lobe at the base of the pinnæ is pinnate, often with several of its simple venules bearing a sorus. The sori form a line on each side of and a little distance from the mid-rib, often crowded, and sometimes confluent, and they are usually confined to the upper part of the fronds. Each sorus is covered by a circular indusium, which is peltate or attached to the vein by a short central stalk.

This rare northern species, of a distinct and elegant character, is found in the fissures of rocks towards the summits of some of our loftiest and bleakest mountains, exposed to storms and blasts, to meet which its constitution seems to be specially adapted. It is found in England, in Wales, and in Ireland, and more abundantly in Scotland, and is also met with in other parts of Europe.

Polystichum Lonchitis is a plant of very tardy increase; the same crown may be cultivated for years without throwing out any offsets for the purpose of propagation. It may be kept in good health if potted *firmly* in well-drained soil. The best situation for it, is a cool moist frame, in which, when established, it will grow with tolerable vigour. Exposed on out-door rockwork, it will rarely be found to have a prolonged existence, unless the damp but well-drained condition of its natural localities can be tolerably

imitated. In removing plants of this, as of the other less easily managed ferns, from their natural habitats for the purposes of cultivation, it is proper not only to take all possible precaution not to injure the roots, but also to select the smaller plants in preference to the larger, as it is found that the former are much more easily established under artificial conditions than are the latter.

2. **Polystichum aculeatum**, *Roth.* — Common Prickly Shield Fern.—Fronds linear-lanceolate or lanceolate, rigid or leathery, bipinnate; pinnules obliquely decurrent or attached by the point of their wedge-shaped base, the anterior basal ones largest, all prickly serrate.

POLYSTICHUM ACULEATUM, *Roth.*: Bab. Man. 411: Florigraph. Brit. iv. 91: Newm. 169 (in part).—ASPIDIUM ACULEATUM, Swartz: Sm. Eng. Fl. iv. 277: Hook and Arn. Fl. 568.—POLYPODIUM ACULEATUM, Linnæus.

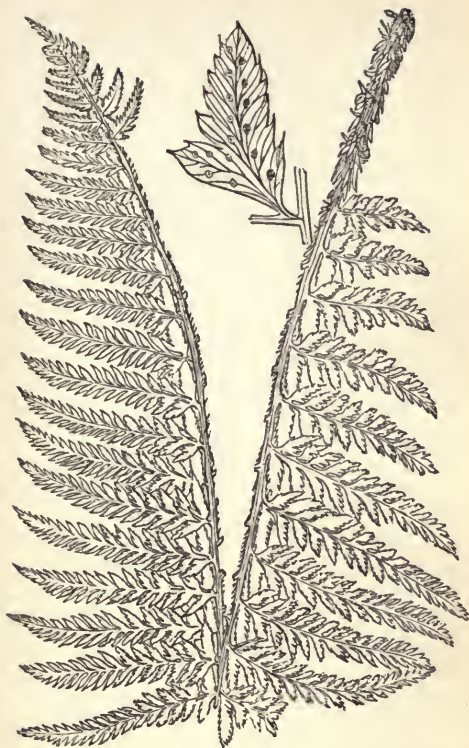
β. obtusum: fronds lanceolate, thick not rigid; pinnules oblong-obtuse, aristate, auricled, crenate-serrate with spinulose teeth.

POLYSTICHUM ACULEATUM, *β. obtusum*, Moore and Houlston in Gard. Mag. Bot. iii. 319.

γ. lobatum: fronds narrow-lanceolate, very rigid; pinnules not auricled, nearly all confluent, prickly serrate.

POLYSTICHUM LOBATUM, Presl.—P. ACULEATUM, Newm. 169 (in part).—P. ACULEATUM *γ.* Florig. Brit. iv. 91.—ASPIDIUM LOBATUM, Swartz: Sm. Eng. Fl. iv. 278: Hook and Arn. Fl. 568: Franc. 33.—POLYPODIUM LOBATUM, Hndson.—POLYSTICHUM LONCHITIDIODES of authors, the *Filix lonchitidi affinis* of Ray, is a starved form of this variety, having the fronds pinnate with the pinnules more combined. (See lower figure in page 90.)

δ. alatum: pinnules crowded, auricled, all connected together by the wing of the rachis.



[*Polystichum aculeatum*.]

The Common Prickly Shield Fern has a large tufted caudex, which is very enduring, and in age acquires a woody character; from it are produced the numerous strong coarse roots and the terminal adherent fronds. The latter are persistent, retaining their verdure through the winter, and their form for three or four years; the young ones grow up about April, and when about half developed, their apex is curved backwards in a very elegant manner. By mid-summer they have reached their full growth. They vary from one to two or three feet in height, and are of a lanceolate figure, and tough rigid and leathery in texture, so that the fronds droop but slightly. The species, however, is not inelegant, the rachis often assuming a lateral curve, and the upper surface of the frond being more or less shining. The stipes is short, and densely scaly, the scales being rust-coloured, large at the base of the stipes, and becoming smaller upwards. The fronds are bipinnately divided, the pinnæ being alternate, and pinnate as far as or beyond the middle, the pinnules either attached to the midrib in a markedly decurrent manner, or else less decurrent and with a more stalk-like attachment, when this is not easily distinguished from *P. angulare*. In the most distinctly stalked examples I have seen of *P. aculeatum*, the base of the pinnule was, however, decidedly wedge-shaped, gradually narrowing from its widest diameter at the auricled part, down to its attachment with the rachis, the base of the pinnule thus forming an acute angle, the point of which touches the rachis; the attachment of the stalk-like base of the pinnule with the rachis also describing an acute angle. Both the form of the base of the pinnule, and the manner in which it is attached to the rachis, in *P. angulare* differ from this, and present, I think, the best means of distinguishing the two plants in their nearly allied states. There is no difficulty whatever in distinguishing them when the pinnules of *P. aculeatum* are less apparently stalked, for the decurrent pinnules afford a certain mark of distinction. The pinnæ of *P. aculeatum* are narrow-lanceolate; the pinnules somewhat crescent-

shaped, acute and aristate at the apex, and fringed with spiny-serratures on the margin. On each pinna the anterior basal pinnule is larger and longer than the rest, the

side next the main rachis being usually straight, and forming a line parallel with it, and the apex pointing directly towards the apex of the frond; a row of these enlarged pinnules is thus found on each side the main rachis. All the pinnules are more or less convex, and, especially the enlarged one, distinctly auricled at their base on the exterior side, the auricles being sharply awned. The midvein of the pinnules branches alternately into free alternate veins, which are generally three or four branched, the lower anterior branch or venule bearing a medial sorus; the vein proceeding up the auricle is pinnately branched with simple venules, several of which produce a sorus. The sori thus form two lines parallel with the midvein of the pinnules and also of their auri-



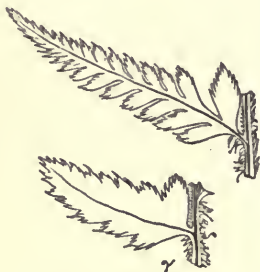
[*Polystichum lobatum*.]

cles; they are often crowded, and sometimes confluent. Each sorus is covered by a circular indusium, attached by its centre, the vein extending beyond it nearly to the margin. This species is common in hedge banks, and similar situations throughout the United Kingdom. It is moreover abundant almost all over Europe; and it, or a closely allied fern, is found in Asia, Africa, and North America.

The variety *obtusum* differs chiefly in the broad blunt form of the pinnules, and their thick but not at all rigid texture. It is cultivated at Kew, and is, we are informed, of British origin.

The variety *lobatum* differs from the typical form of the species in the narrow-lanceolate outline of its fronds, and in having its pinnules all decurrent or more or less confluent. The form of the pinnules is also different, for they

are never (or rarely very slightly) auricled, both the anterior and posterior margins being rounded; so that they are more ovate than lunate. In other respects—in its subevergreen fronds adherent to the tufted caudex; in its rigid texture, and shining surface; in the prickly serratures of its pinnules, and in the enlarged anterior basal pinnule on



[*Polystichum lobatum*, vars.]

each pinna, it quite agrees with *P. aculeatum*, from which the numerous intermediate stages, and above all the interchanges observed under cultivation of *lobatum* to *aculeatum*, and *vice versa*, forbid its being

separated as a species. It is equally common or more so than the typical form.

The variety *alatum* is a remarkable one, agreeing with *P. aculeatum* in the form and texture of its pinnules, which are crowded, and all connected by a broad even wing or margin extending along each side of the rachis of the pinnæ, very different from the confluence of the pinnules which occurs in the variety *lobatum*. The main rachis is rather abundantly furnished with long very narrow ferruginous scales, which may indicate a close relationship with *P. angulare*. It was found in 1853 near Selworthy in Somersetshire by Mrs. Archer Thompson, to whom we are indebted for the specimens described.

P. aculeatum and its varieties are easily grown, and are ornamental plants either for rock-work, or for pot-collections. They should be planted in well-drained sandy loam, and prefer a moderately shady situation.

3. *Polystichum angulare*, Presl.—Angular or Soft Prickly Shield Fern.—Fronds lanceolate lax bipinnate; pinnules with an obtuse-angled distinctly-stalked base, acute or obtuse, prickly-serrate.

POLYSTICHUM ANGULARE, Presl: Newm. 173: Bab. Man. 412: Florigr. Brit. iv. 95.—ASPIDIUM ANGULARE, Willdenow: Sm. Eng. Fl. iv. 278: Eng. Bot. Supp. 2776: Hook and Arn. Fl. 568.—A. ACULEATUM, Kunze.

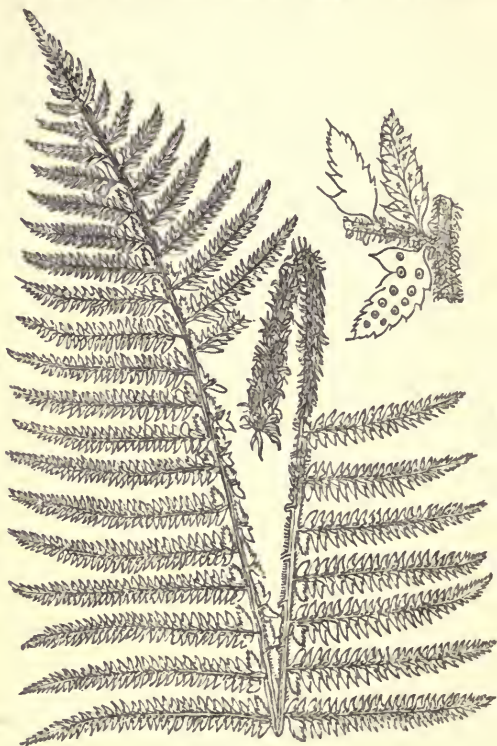
β. subtripinnatum: lower pinnules deeply pinnatifid, the lobes sometimes distinct.

ASPIDIUM ANGULARE *β. subtripinnate*, Hook and Arn. Fl. 568.

γ. angustatum: pinnules all small, narrow, very acute; fronds proliferous near the base.

The Angular Prickly Shield Fern forms a large tufted caudex, sometimes erect and trunk-like in age, and as it usually throws out numerous lateral crowns, an old plant

often consists of several crowns attached to the same base, from which the numerous strong coarse roots are pro-

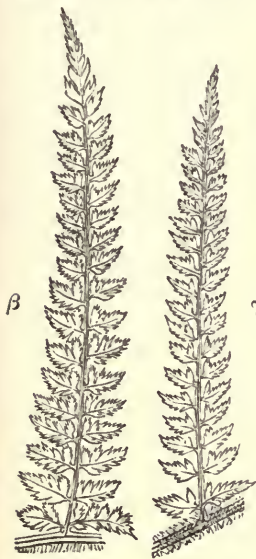


[*Polystichum angulare*.]

truded. The fronds are persistent, and adherent at the base to the tufted caudex; they are remarkably elegant, retaining their verdure throughout the winter, and the old undecayed fronds of preceding years, though dead and

entirely discoloured, are usually found about the base of the plants. The whole plant is softer, more lax and delicate in texture, and more shaggy than in the nearly allied *P. aculeatum*. The stipes is from one-fourth to one-third the length of the frond, and is densely clothed with coarse reddish rust-coloured chaffy scales, which also cover both the main and the secondary rachis, the scales becoming smaller upwards, and at length hair-like. The fronds are lanceolate and bipinnate, usually from two to three feet, but sometimes four or five feet high, the outline generally broader than in *P. aculeatum*, and the habit pendent.

A vigorous old crown frequently produces as many as thirty or more fronds, which, under any

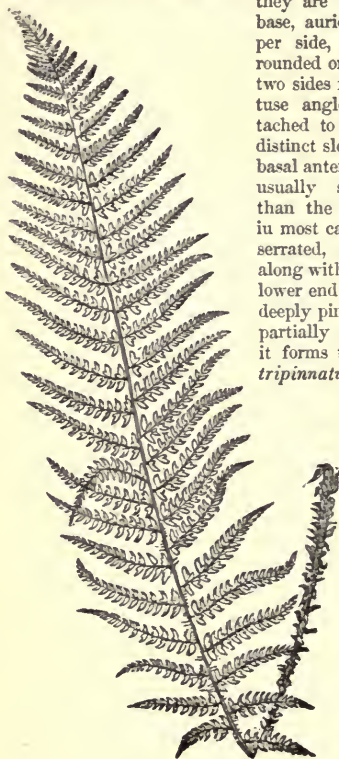


[*Polystichum angulare*
β and γ.]

circumstances, from the laxity of their habit, assume a beautiful and graceful attitude. The pinnae are numerous, elongate linear-lanceolate, distinct, often distant, four to five inches long. The pinnules are flat, somewhat crescent-shaped, and either acute or bluntish, distinctly and often

deeply serrated on the margins, with spinulose-serratures; they are truncate at the base, auricled on the upper side, and somewhat rounded on the lower, the two sides forming an obtuse angle, which is attached to the rachis by a distinct slender stalk. The basal anterior pinnules are usually scarcely larger than the others, but are in most cases more deeply serrated, and sometimes along with others near the lower end of the pinnæ are deeply pinnatifid, or even partially pinnated (when it forms the variety *subtripinnatum*). Various de-

grees of this subtripinnate condition are, however, met with. The base of the pinnules in *P. angulare*, instead of forming an acute angle, as described under *P. aculeatum*, forms a very obtuse angle, the point of the angle being not attached directly to the rachis as in



[*Polystichum subtripinnatum*.]

that, but connected therewith by a short and slender but distinct stalk, which again is joined to the rachis at a more obtuse angle than is the case with the pinnules of *P. aculeatum*. In the outline of the pinnules, as well as in the prominence of the spinulose marginal serratures, there is much variation in different plants. Scattered on the under surface of the pinnules are fine hair-like scales. The midvein of each pinnule branches alternately; the veins are again branched, and the anterior venule bears a sorus, and is scarcely continued beyond it; the other venules extend to the margin, and are sometimes simple, sometimes forked. The lobe or auricle at the base of the pinnule has a vein through its centre, throwing off simple venules, some of which are fertile. The sori are numerous, often crowded, sometimes confluent; and covered by nearly circular indusia, depressed in the centre, at which part they are attached to the veins—thus being peltate.

The variety *subtripinnatum*, is a more highly developed state of the species, in which all the lower pinnules (the basal ones in particular) are deeply pinnatifid, the segments sometimes becoming almost distinct. Being thus somewhat more deeply divided, and at the same time usually of larger growth than the ordinary *P. angulare*; it is a more lax and more elegant plant. It is not uncommon.

The variety *angustatum*, though sharing the elegant character of the species, is perhaps less graceful than it or the more divided variety. Its peculiarity resides in the very narrow and acute pinnules, which are rather more distinctly stalked than in the common forms of *P. angulare*. It is further remarkable in being viviparous in the axils of the lower pinnæ. It has been found in the neighbourhood of Wimbledon, and is preserved in the Royal Botanic Garden at Kew.

Another proliferous form of this species has been sent me from Ireland by Mr. Kinahan under the name of *viviparum*. It is a curious depauperated monstrosity,

and quite dwarf; the pinnae usually reduced to a mere rib, or when at all approaching the normal form, they are wedge-shaped at the base, and above cut into deep narrow lobes ending in subulate teeth.

The species (not uncommonly known among British botanists as *Polystichum aculeatum*), appears to be abundantly distributed throughout England, as far north as Yorkshire; also in Wales, and in some parts of Ireland. Of its occurrence in Scotland we have no authentic information excepting in one locality in Berwickshire. It prefers lowland sheltered woods and hedge banks, where the soil is moist, and in such situations grows with much luxuriance. The same species is met with in other parts of Europe.

It is a very easily cultivated plant, growing freely in any light soil, especially such as is enriched by decayed leaves. For rock-work, it is one of the most ornamental of all our hardy species, and its persistent evergreen habit is, in such a place, a great additional recommendation. It should be planted in a well-drained and shady situation. In wilderness scenery it would be quite at home, and no plant could be more appropriate or effective in such situations. It is readily cultivated in pots, requiring, however, a considerable share of pot-room, and to be kept in a cool and shady place.

GENUS VII.

LASTREA, Presl.

BUCKLER FERN.

GEN. CHAR.—*Sori* nearly circular, indusiate, attached at the back of the lateral veins. *Indusium* irregularly reniform, attached by the sinus. *Veins* free; midvein distinct; venules simple or branched.

The name *Lastrea* was originally applied by Bory de St. Vincent to a group of *Polypodium*, including *Oreopteris*, *Thelypteris*, *Phegopteris*, *Dryopteris*, and *Robertianum*, and was intended to mark a sectional division. The name was subsequently adopted by Presl, for one of his new genera which included the majority of Bory's species. Presl's genus embraces the greater part of the British species which were referred to *Aspidium* as defined by Swartz. The common male fern (*Lastrea Filix-mas*) may be regarded as the type. I have here adopted as an English name for the genus, that of Buckler Fern, being an equivalent for Shield Fern, which was borne by the old genus *Aspidium* of which *Lastrea* forms a considerable part; that name being more properly restricted to the group now called *Polystichum*.

The systematic name of the genus was applied in honour of M. Delastre, of Chatelleraut, a zealous botanist, and an excellent microscopical observer.

1. **Lastrea Thelypteris**, Presl.—Marsh Buckler Fern.—Fronds lanceolate with a broad base, pinnate, glandless; pinnæ linear-lanceolate, deeply pinnatifid; lobes oblong, the edges revolute in the fertile fronds, which thus appear contracted.

LASTREA THELYPTERIS, Presl: Bab. Man 409: Newm. 183: Florigr. Brit. iv. 96.—*ASPIDIUM THELYPTERIS*, Swartz: Sm. Eng. Fl. iv. 272: Hook and Arcl. Fl. 569: Franc. 35.—*POLYPODIUM THELYPTERIS*, Linnæus.—*ACROSTICHUM THELYPTERIS*, Linnæus.—*POLYSTICHUM THELYPTERIS*, Roth.—*THELYPTERIS PALUSTRIS*, Schott.—*HEMES-
THEUM THELYPTERIS*, Newman, App. xxii.

The Marsh Buckler Fern has a very widely extended creeping caudex, which is slender, dark-coloured, nearly smooth, and furnished with matted fibrous roots. The fronds which perish annually, and are renewed, the barren ones about May, the fertile ones about July, are slender and fragile, erect,



[*Lastrea Thelypteris*.]

six to eighteen inches 'or more in height, smooth, delicate, almost membranous, pale green, lateral, and adherent to the caudex. The stipes is slender and smooth. The fronds are lanceolate scarcely narrowed at the base, pinnate. The pinnæ are often opposite, but sometimes alternate, distant, slightly drooping, the longest one and a half to three inches long, all pinnatifid, with crowded entire oblong rounded lobes. The fertile fronds are similar to the barren ones, but taller and more robust; sometimes upwards of three feet high, with distant alternate pinnæ occupying the upper third of the frond. These fertile fronds have the margin of their lobes revolute, and this gives the latter the appearance of being narrower and more pointed than those of the barren fronds. The midvein of the lobes is distinct, and somewhat sinuous, producing free alternate venules, which are usually forked near the mid-vein, with the branches continued to the margin. In weak specimens some of the veins are simple, and in luxuriant ones they sometimes have more than two branches. Each branch usually bears at about half way between the margin and mid-vein a small roundish sorus, which in its earlier stages is covered by a thin white reniform indusium, soon becoming pushed aside and lost. The sori thus form a submarginal line, and finally become confluent, or nearly so, and are partially covered by the reflected margin of the lobe.

This species is rare and local, though widely dispersed. It is only found in boggy and marshy places, and when present is generally abundant, being a free grower, and rapidly extending itself by its long creeping caudex. It occurs all over England and Wales and in all the Irish provinces, but in Scotland it is uncommon. It is found throughout Europe, and both in Asia, Africa, and America.

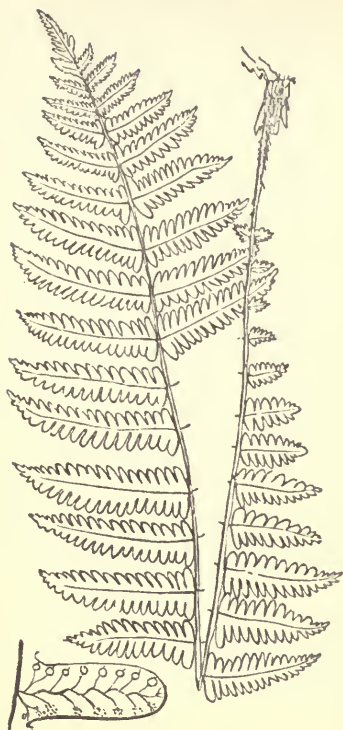
This fern grows freely under pot-cultivation if planted in wide pots, and in turfy peat soil mixed with decaying tree leaves, and kept in a moist state; though it does not very freely produce its fertile fronds when thus grown.

When vigorous it is nevertheless an elegant and delicate looking species. Probably its want of fertility under such circumstances may be in consequence of its extensively creeping stems being too much restricted within a garden pot, and a wide shallow pan would be more congenial to its habits. When introduced about rock-work it should be at the base where its natural boggy habitat may be imitated. It propagates readily by division of the caudex.

2. *Lastrea Oreopteris*, Presl.—Mountain Buckler Fern.—Fronds lanceolate narrowed below, pinnate, glandular beneath; pinnæ linear-lanceolate, widest at the base, deeply pinnatifid; lobes oblong flat.

LASTREA OREOPTERIS, Presl: Bab. Man. 410: Newm. 188: Florigr. Brit. iv. 98.—*LASTREA MONTANA*, T. M. MS.—*ASPIDIUM OREOPTERIS*, Swartz: Sm. Eng. Fl. iv. 273: Eng. Bot. 1019: Hook and Arn. Fl. 569: Franc. 36.—*POLYPODIUM OREOPTERIS*, Ehrhart.—*POLYPODIUM MONTANUM*, Vogler.—*POLYSTICHUM MONTANUM*, Roth.—*HEMESTHEUM MONTANUM*, Newm. App. xxii.

The Mountain Buckler Fern has a large tufted scaly caudex, from which spread in all directions strong entangled fibres. The fronds appear in May, and are numerous, semi-erect, terminal, adherent, rising up around the caudex, to the height of two or three feet. They are lanceolate, pinnate, leafy nearly to the base, and remarkably narrowed there, the pinnæ gradually decreasing in size from about the middle of the frond. The stipes is very short, and covered with pale brown scales, and when in a young state small hair-like scales are numerous on the rachis among the lower pinnæ. The pinnæ are usually opposite, the lower ones short deltoid obtuse, gradually lengthening upwards to the middle of the frond, where they are linear-lanceolate, three to nearly six inches long, broadest at the base, and tapering to a long narrow point; the upper ones decrease in length and also in breadth; all are deeply pinnatifid, the lobes flat, obtuse, and entire,



[*Lastrea Oreopteris*.]

rarely slightly crenate towards the apex. The under surface of the fronds is scattered over with numerous yellowish glands, which, when bruised, emit a strong and pleasant balsamic odour. The lobes have a distinct and slightly sinuous mid-vein with free alternate venules, which are sometimes branched and sometimes simple, all extending nearly, but not quite, to the margin, and bearing the sori near their extremity. The sori form a crowded submarginal series, and at length become nearly confluent; they are at first covered by a small thin jagged indusium which is soon obliterated.

This species is an inhabitant of mountainous heaths and of moist woods. It is common in England and Wales, particularly abundant in Scotland, more local in Ireland, but nevertheless occurs in all the provinces of Great Britain except the Channel Isles from whence it is not recorded. It is, moreover, met with throughout Europe, but is said to be confined to this quarter of the globe.

This fern is not much given to variation. A form, however, in which the pinnules are much crisped or undulated, has been found in the Clova mountains by Dr. Balfour.

The roots of this fern are rather difficult to get established under cultivation, much more so than its commonness would seem to render probable. To obviate this, smaller plants should be selected rather than larger ones. If grown in pots it requires them to be well drained, and of considerable size. The plant is very elegant, and may be introduced with good effect in shady situations, among rockwork. It is also suitable for the decoration of "wilderness" walks, as it grows very luxuriantly in woods. When once it becomes established, it grows more freely, thriving, however, best in shady situations. It may be propagated, sparingly, by detaching any lateral crowns that may be formed around the old plants; but grows very freely from the spores.

3. **Lastrea Filix-mas**, Presl.—Male Fern, or Common Buckler Fern.—Fronds lanceolate sub-bipinnate, pinnæ linear-lanceolate; pinnules oblong the basal ones more or less distinct, the rest confluent, their serratures not spinulose; sori uniserial near the midrib; indusium convex very persistent, without glands on the margin:—

α. — sub-bipinnate; pinnules obtuse-oblong, distinct with a broad attachment, or connected at the base, crenato-serrate; venules forked or three-branched; sori confined to the lower half of pinnules.

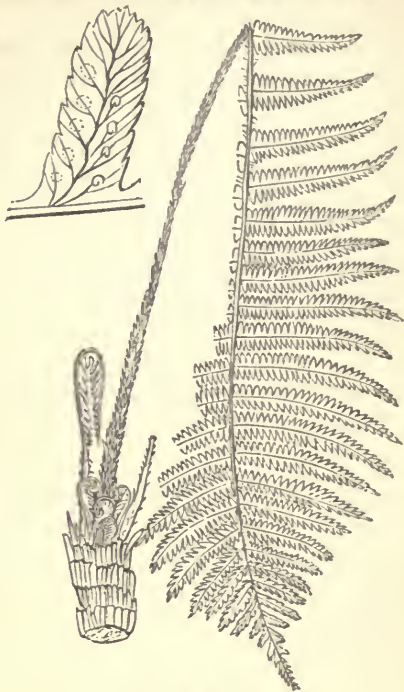
LASTREA FILIX-MAS, Presl: Bab. Man. 410: Newm. 197: Florigr. Brit. iv. 103.—ASPIDIUM FILIX-MAS, Swartz: Sm. Eng. Fl. iv. 275: Eng. Bot. 1458 and 1949: Hook and Arn. Fl. 569: Franc 38.—POLYPODIUM FILIX-MAS, Linnæus.—POLYSTICHUM FILIX-MAS, Roth.—DRYOPTERIS FILIX-MAS, Schott.—LOPHODIUM FILIX-MAS, Newm. App. xx.

β. incisa: more robust; bipinnate; pinnules elongate-oblong acutish, deeply incised, the lobes serrate; venules many-branched; sori usually extending further up the pinnules.

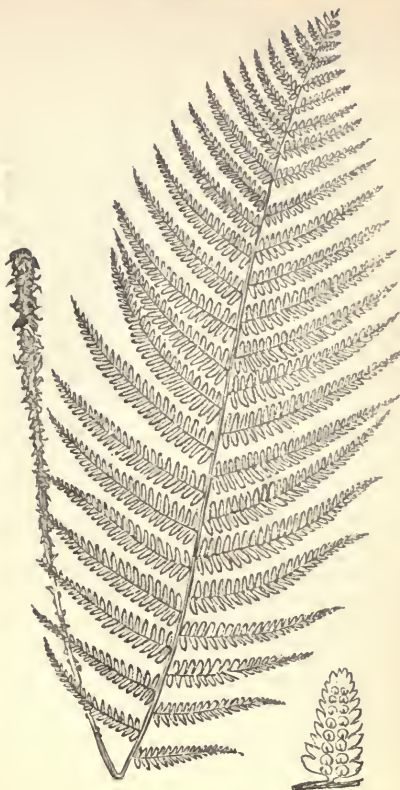
LASTREA FILIX-MAS, *var. incisa*, Moore, Phytologist (1848) p. 137: Bab. Man. 410.—LASTREA EROSA, Deakin, Florigr. Brit. iv. 101.—ASPIDIUM FILIX-MAS, *var. erosum*, Hook and Arn. Br. Fl. 569.—ASPIDIUM DEPASTUM, Schkuhr (monstrous).—ASPIDIUM EROSUM, Schkuhr, according to Deakin and Arnott, but hardly so Schkuhr's plant having a glandular indusium and a winged secondary rachis.—ASPIDIUM AFFINE, Fischer and Meyer, according to Arnott.—LOPHODIUM EROSUM, Newm.—POLYPODIUM HELEOPTERIS, Borkhausen, according to Deakin.

γ. abbreviata: dwarf, sub-bipinnate; pinnules small and confluent; sori usually confined to the anterior venule of each pinnule, thus arranged in a single line near the rachis of the pinnæ.

LASTREA FILIX-MAS, *var. ABBREVIATA*, Bab. Man. 410.—POLYSTICHUM ABBREVIATUM, De Candolle.—LOPHODIUM ABBREVIATUM, Newman.—ASPIDIUM FILIX-MAS, *var. RECURVUM*, Francis.



[Lastrea Filix-mas.]



[*Lastrea Filix-mas*, var. *incisa*.]

♂. *cristata*: fronds narrow elongate; pinnules contracted and confluent; apex of frond and of pinnæ multifid-crisped.

LASTREA FILIX-MAS, var. CRISTATA, Moore and Houlston, Gard. Mag. Bot. iii. 317.

The Male Fern, or Common Buckler Fern, has a large tufted caudex, gradually elongated, becoming in aged plants often elevated above the surface and producing numerous strong dark brown, deeply penetrating roots. Sometimes, however, it assumes a decumbent position, the crown being curved at the extremity, from which the fronds arise, nearly or quite erect. The fronds grow up in a circle several from each crown, to which they are terminal and adherent; they grow to the average height of two to three feet, and bear pinnæ to within about a third of their length from the base. The young fronds appear annually in May; their vernation is at first circinate, but in a few days after development commences, the apex becomes liberated, and bent downwards, acquiring a curve similar to that of a shepherd's crook. The stipes is short, and usually, together with the rachis, densely covered with narrow membranous chaffy pale brown scales of various size. The fronds are sub-bipinnate in the normal form of the species, broadly lanceolate, or not unfrequently oblong-lanceolate, with an abrupt acuminate apex. The pinnæ are linear lanceolate, acute, alternate, spreading, the lowest shorter than those about the middle of the frond, which are from four to six inches long; they are pinnate at the base, the pinnules having usually a broad attachment, and in the upper part of the pinnæ becoming more or less combined. The pinnules and lobes are oblong-obtuse, crenato-serrate on the margin, and more acutely and closely serrate at the apex. The mid-vein of the pinnules is sinuous; the venules alternate, becoming branched near the mid-vein, either simply forked, or when vigorous having the

[*Lastrea Filix-mas*, var. *incisa*.]

posterior branch again forked, or sometimes becoming still more divided. The anterior branch on a greater or less number of these venules towards the base of the pinnule, bears a sorus just above its origin, the sori forming a short line on each side near to the mid-vein, and extending about half the length of the pinnule. The sori are covered by very persistent reniform convex indusia, which are smooth, that is, without projecting glands on their margin, and are connected to the back of the veins by their sinus, which is turned towards the rachis. The fructification, which is confined to the upper part of the fronds, becomes mature about August, and in favourable localities the fronds remain for a considerable period in a perfect state.

The variety *incisa* may be considered as a more highly developed condition of the plant. It is of more robust

habit, and grows three to four feet high. The fronds, which are distinctly bipinnate, are lance-shaped in outline, and do not, as is frequent in the normal plant, abruptly contract into an acuminate apex. The pinnules are also less crowded; those near the base of the pinnæ being narrowed where they are connected with the rachis, frequently but not always considerably so; in form they are more elongate, and narrowed into a somewhat acute apex, the margins more or less deeply inciso-lobate, with the lobes cut into from two to five serratures. The venules are more numerous, several being developed from each vein, one of these extending up the centre of each lobe, those near the base of the pinnule producing the most numerous venules. The sori however, are, notwithstanding the more compound venation, produced only by the lower anterior branch, so that they here also form a single line on each side the midrib, only they are commonly extended further up the pinnule and often reach almost to its apex. The indusium is convex, without any marginal glands, and is often met with smaller and less persistent, than in the form we have considered the normal plant. Irregular and monstrous developments of this variety seem to constitute the *Aspidium depastum* of Schkuhr, of which the fronds are broader, with large deeply lobed oblong pinnules occurring along with smaller deformed ones. The variety *incisa* is probably equally common with the type form. We have seen specimens from the counties of Devon, Somerset, Wilts, Dorset, Kent, Surrey, Hertford, Northampton, Hereford, Derby, and Cumberland, in England; and from those of Lanark, Perth, and Kincardine in Scotland.

The variety *abbreviata* is a dwarf plant not exceeding a foot in height, and it is remarkable in having the pinnæ curved backwards so that the upper surface of the frond is concave. The stipes is very short. The outline is narrow lanceolate; the pinnæ one and a half to two inches long and bluntnish at the apex. The pinnules, which are all connected at the base, one or two of the

lowest only being cut down nearly to the rachis, are small, obtuse, with very blunt serratures. The venation is much simpler than in the forms already noticed, and more resembling that of the lobes of the var. *incisa*. The mid-vein produces a series of alternate venules, which are simple or sometimes forked, and usually the lowest anterior venule only bears a sorus, so that they form scarcely more than a simple line on each side the rachis about even with the sinus of the pinnules. One or two of the basal pinnules sometimes produce two or three sori. The indusium is convex and persistent. This variety has been found in Durham at Teesdale by Mr. J. Backhouse; in Yorkshire at Ingleborough, and in Cumberland by the Rev. G. Pinder; at Coniston in Lancashire by Miss Beever; and, in 1851 near Llyn Ogwen in Carnarvonshire by Mr. S. O. Gray.

The variety *cristata* is perhaps one of the handsomest ferns in existence, and though a monstrosity, is, like many other of the monstrosities that occur among the ferns, reproduced without variation from the spores. The fronds are about two feet high, narrow lanceolate, with rather distant pinnae, which, at the widest part of the frond, are about two inches in length; they are narrow, tapering from the base upwards. The apex of the frond, and of every pinna, is multifidly-forked, and symmetrically developed into a tasselled tuft of crisped segments, exactly as occurs in *Athyrium Filix-fœmina*, var. *multifidum*. The fructification is copious on the upper part of the fronds, and quite agrees with that of the normal form of the species. It was found at Charleston, near St. Austell in Cornwall, and is cultivated in the Royal Garden at Kew.

Another form, perhaps entitled to rank as a variety, mentioned in Hooker and Arnott's *British Flora* as occurring abundantly in Devonshire, is found by Mr. Backhouse in Yorkshire, Durham, and the Clova district. Its chief peculiarities are a yellowish green colour, a great abundance of long hair-like ferruginous scales on the pri-

mary and secondary rachises, and minute though copious sori. It might be distinguished as a variety by the name of *paleacea*.

The typical form of *Lastrea Filix-mas* is one of our commonest ferns, abounding everywhere, in wooded and in shady situations, and occurring commonly in hedge banks. It is met with over the whole continent of Europe, and is widely dispersed elsewhere.

The Male Fern, in conjunction with the Common Bracken (*Pteris aquilina*), is applied to various economic uses, such as the dressing of leather, the manufacture of glass, the bleaching of linen, &c.—uses which will hereafter be noticed in treating on that species. The inhabitants of Siberia are said to boil the Male Fern in their ale to improve its flavour. In Norway the dried fronds are infused in hot water, and thus form a palatable food for cattle, sheep, and goats, which eagerly eat and even fatten upon it. In the dried state it forms a warm litter for cattle, or a good light protective covering for plants; and either in the fresh or decayed state is useful as manure. Medicinally it has obtained some celebrity as an anthelmintic, in which character it was known to the ancients. Formerly it was employed much more frequently than now, not, however, it appears so much on account of its inefficiency, as from the greater facility with which other and perhaps better understood agents are procured. Thus Gerard writes:—"The roots of the male fern, being taken to the weight of half an ounce, driveth forth long flat worms, as Dioscorides writeth, being drunk in mede or honied water, and more effectually if it be given with two scruples, or two third parts of a dram of scamonie, or of black hellebore; they that will use it, must first eat garlicke." The famous remedy of Madame Nonffer, of Switzerland, for expelling tape worms had this plant for its basis. In the form of ethereal extract, from 12 to 24 grains form a dose (at night and again in the morning) or from 1 to 3 drachms of the powder. The inner parts of

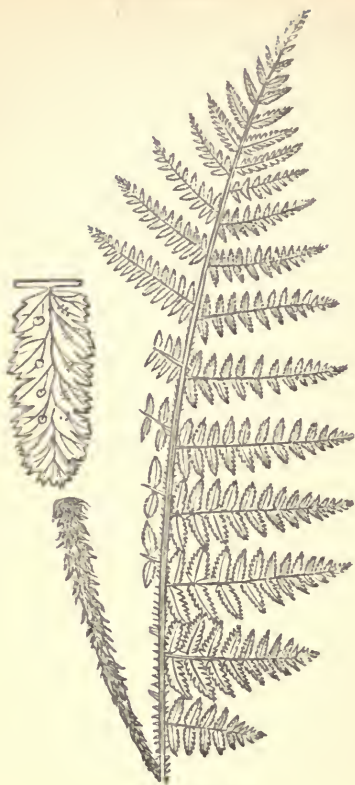
the fresh caudex, and of the portions of leaf-stalk attached to it, which are fleshy and of a light greenish colour, should only be employed, and this should be renewed annually, and kept close from the air. This species is supposed to have been the *pteris* of Dioscorides, according to Dr. Royle, who states that several ferns were no doubt employed medicinally by the ancients.

This very common Fern is ornamental when in vigorous health; it may be planted about shady walks, in woods and wilderness scenery, and on the shady sides of rockwork. As a pot plant it requires abundance of space for its roots, a sandy loamy soil, and, beyond these, nothing more than ordinary attention in affording it a supply of water in summer, and plunging the pots in any loose dryish material in a sheltered situation out-doors for the winter.

4. *Lastrea rigida*, Presl.—Rigid Buckler Fern.—Fronds lanceolate, broad at the base, bipinnate, glandular; pinnules oblong, blunt, slightly pinnatifid, the segments broad rounded two to five toothed, the teeth not spinulose; indusium persistent, fringed with glands.

LASTREA RIGIDA, Presl: Bab. Man. 411: Newm. 191.—*ASPIDIUM RIGIDUM*, Swartz: Eng. Bot. Supp. 2724: Hook. and Arn. Fl. 569: Franc. 40.—*ASPIDIUM FRAGRANS*, Gray.—*POLYPODIUM FRAGRANS*, Linnæus in part.—*POLYPODIUM RIGIDUM*, Hoffman.—*POLYSTICHUM STRIGOSUM*, Roth.

The Rigid Buckler Fern has a decumbent caudex, producing long wiry roots, and numerous fronds, which are nearly or quite erect, from one to two feet high, their surface sprinkled with numerous minute spherical nearly sessile glands, which are much more conspicuous in the fresh than in the dried plant, and give it a slight but peculiar fragrance. The stipes is short, usually about a third of the height of the frond, but sometimes longer, densely clothed especially at the base where it is much thickened,



[Lastrea rigida.]

with long narrow sharp-pointed reddish-brown membranous scales, which become smaller and less abundant upwards, but are continued in a hair-like form up the rachis. The fronds are bipinnate, more or less lanceolate; in some cases where the lower pinnæ are slightly shorter than those above them, they are truly lanceolate; in other instances the lowest pinnæ are somewhat the longest, the upper ones gradually decreasing in size, and when this is so, they are of a narrow and elongated triangular outline, which appears to be the normal form in the mature plants. The longest pinnæ in vigorous fronds measure from two to three and a half inches in length. The short lower pinnæ of the lanceolate form are broader and more distant than the upper ones, and have a triangular outline; whilst the lower pinnæ of the triangular form are of about the same width as those of the lanceolate form, but twice their length, and therefore much narrower in proportion. The pinnæ are all pinnate, alternate, tapering from the base upwards, broadest in the lower part of the frond, the upper ones gradually becoming narrower. The pinnules are oblong, truncate below, usually with a narrow stalk-like attachment, but sometimes slightly decurrent, more or less deeply pinnatifid, the lobes serrated, with from two to five acute, but not spinulose teeth. They have a sinuous mid-vein, with alternate veins, each of these producing three or more venules, the lowest anterior one of which bears a sorus a short distance from its origin. One vein is projected into each of the lobes, and the number of venules is accordant with the number of marginal teeth, one being directed to each serrature. From this disposition of the veins the sori become ranged in a line on each side and near to the mid-vein, and are usually so near together as soon to become confluent, and occupy the central part of the pinnule. They are each covered by a persistent reniform indusium, the sinus of which is turned towards the base of the pinnule, and the margin is fringed with stalked glands.

This is a rare and local species, entirely confined, as far as regards Great Britain, to limestone hills in the mountainous districts in the counties of Westmoreland, Lancashire, and Yorkshire. The Rev. W. Bree first found it at Ingleborough in Yorkshire. The Rev. G. Pinder met with it in great profusion along the limestone district, between Arnside Knot (near Silverdale, Westmoreland), where it is comparatively scarce, and Ingleborough, being most abundant on Hutton Roof Crag and Farlton Knot, where it grows in the deep fissures of the natural platform, and occasionally high in the clefts of the rocks. It is generally much shattered by the wind, or cropped by the sheep, which seem to be fond of it. It grows abundantly in the fissures of limestone rocks, near Settle, in Yorkshire, at an elevation of 1,550 feet. It is also recorded as a native of various European countries.

This is an easily managed and elegant plant under cultivation, and flourishes well in a shady peat border or planted in turfy peat soil, intermixed with small lumps of broken limestone. It should not be kept too moist, and the crown should be raised above the surface.

5. *Lastrea cristata*, Presl.—Crested or Narrow prickly-toothed Buckler Fern.—Fronds erect, narrow linear-oblong or lanceolate pinnate or bipinnate; serratures spinose-mucronate; scales of the stipes ovate scattered; indusium without marginal glands:—

[I unite the following forms under one species, because although the two extremes are apparently distinct, they are so closely connected by the intermediate form (*uliginosa*) as to be undistinguishable from one or other of the conditions which the latter assumes. In doing this I believe I am recurring to the views held by Linnæus. The group thus associated, though readily distinguished from the allied group which I regard as varieties of the following species, and with which this is associated by some, does not appear to me to offer sufficient marks for the specific separation of the plants I have assigned to it.]

α.——: fronds narrow linear-oblong, pinnate; pinnæ short triangular-oblong, with oblong pinnules or segments which are nearly always connected at the base, crenato-serrate or obscurely lobed, with aristate teeth; inferior and superior basal pinnules nearly equal in size.

LASTREA CRISTATA, Presl: Bab. Man. 410: Newm. 203: Florigr. Brit. iv. 107.—LASTREA CALLIPTERIS, Newm.—ASPIDIUM CRISTATUM, Swartz: Sm. Eng. Fl. iv. 276: Eng. Bot. 2125: Hook. and Arn. Fl. 569: Franc. 30.—POLYPODIUM CRISTATUM, Linnæus (in part).—POLYPODIUM CALLIPTERIS, Ehrhart.—POLYSTICHUM CRISTATUM, Roth.—LOPHODIUM CALLIPTERIS, Newm. App. xix.

β. uliginosa: fronds (earlier fertile ones) narrow, linear-lanceolate, bipinnate below; pinnules oblong-acute, mostly adnate, inciso-serrate or lobed, with aristate teeth: inferior and superior basal pinnules nearly equal in size.

LASTREA CRISTATA, *var. ULIGINOSA*, Moore, Trans. Bot. Soc. Edin. iv., 109; and Phytol. iv., 149: Bab. Man. 410.—LASTREA ULIGINOSA, Newman.—ASPIDIUM SPINULOSUM, Hook. and Arn. Fl. 571 (in part).—ASPIDIUM SPINULOSUM, *var. ULIGINOSUM*, A. Braun.

γ. spinulosa: fronds narrow oblong-lanceolate, bipinnate; pinnules oblong-acute, incised or pinnatifid, with aristately toothed lobes; inferior basal pinnules much larger than the superior ones.

LASTREA SPINULOSA, Presl: Bab. Man. 410.—LASTREA SPINOSA, Newman: Florigr. Brit. iv. 103.—LASTREA DILATATA, *var. LINEARIS*, Bab. Man. 1 ed.—POLYPODIUM CRISTATUM, Linnæus (in part).—POLYPODIUM SPINULOSUM, Muller (1770): Withering (1796).—POLYPODIUM FILIX-FEMINA, *var. SPINOSA*, Weiss (1770).—POLYSTICHUM SPINOSUM, Roth.—LOPHODIUM SPINOSUM, Newm. App. xviii.

The Crested Buckler Fern has a stout short decumbent or slowly creeping caudex, which occasionally emits a lateral branch, and produces numerous dark brown matted

roots. The fronds grow up in May quite erect, in a small tuft from each crown; they are terminal, and adherent,



[*Lastrea cristata*.]

from one to three feet high, narrow-linear-oblong in outline, not narrowed towards the base. In vernation they are circinate, with the pinnæ flat, and rolled inwards from the point. The stipes is one-third or more the height of the fronds, and is very stout and shining, and furnished sparingly with broad obtuse uniformly pale brown chaffy

scales, most abundant at the base.

The base of the stipes of the older fronds bears rude semi-lunar markings, indicating the former attachment of these scales. The fronds

are pinnate; the pinnæ—which are produced in pairs, but seldom exactly opposite, those towards the apex of the fronds becoming decidedly alternate, and rather distant, the distance decreasing from the base towards the apex—are attached to the rachis by a little stalk, and though elongate triangular are short as compared with the kindred species, and are deeply pinnatifid, so that the fronds become almost bipinnate. The pinnules are ovate-oblong, blunt, almost invariably decurrent

at the base; sometimes one or two of the basal ones are very slightly stalked, and they are usually more or less crenately lobed, all the lobes being fringed with fine sharp bristly teeth. In luxuriant fronds the pinnæ are somewhat more elongated than ordinary, and the basal pinnules more distinct. The inferior pinnules are generally somewhat longer than the superior ones, but the enlargement is here but slight.



[*Lastrea cristata*.]

The mid-vein of the pinnules is sinuous, producing alternate venules, which have several branches, the anterior of which only bears a sorus, and this is generally situated about halfway between the midrib and the margin, so as to form a more or less distinct line, though in luxuriant specimens the sori become crowded and confluent. The



[*Lastrea uliginosa*!]

fructification is usually either confined to or most abundant on the upper part of the frond; sometimes, however, extending down to the second pair of pinnæ from the base. The sori are covered by reniform indusia, which are somewhat irregular on the margin, but without glands, and are attached by a deep sinus, the anterior margin being free. The larger of the two annexed figures of this fern represents a barren cultivated frond, and the smaller a wild fertile frond drawn to a more reduced scale.

The variety *uliginosa* is exactly intermediate between what we take as the normal forms of *L. cristata* and *L. spinulosa*, differing from each in certain particulars in which it agrees with the other. It has a stout decumbent caudex, and erect linear-lanceolate fronds, two to three feet high, and bipinnate at the base of the pinnæ. It bears three kinds of fronds. When the young fronds of a mature plant are produced, which usually takes place some days earlier than in the case of *L. cristata* and later than that of *L. spinulosa*, some of them are fertile and others barren. The latter are somewhat spreading, smaller, pinnate, with decurrent oblong-obtuse pinnules, and exactly re-

sembling the infertile fronds of *L. cristata*. The former are erect, larger, pinnate, the pinnules being distinct below, adnate above, oblong-acute, inciso-serrate or lobed, with aristate teeth, the whole of the frond being fertile, and the inferior pinnules larger in a small degree than the superior ones. Later in the summer another kind of frond is produced, large, stout and fertile, but with the pinnules of the same form as those of the earlier barren fronds. The pinnae, especially in the earlier fertile fronds, are twisted so that their upper face instead of lying in the plane of the frond is directed towards the zenith, the fronds being nearly or quite erect. The vernation is circinate, with the pinnae flat and rolled inwards from the point as in *L. cristata*. One of the accompanying figures (marked !) represents the earlier form of fertile frond, and the other (*) the anomalous form which is produced later in the season, but the differences between them are not very obvious in drawings on so reduced a scale. In this variety, the stipes is about a third the length of the frond, sparingly furnished with blunt ovate pale-coloured scales, similar to those on the other two forms.

[*Lastrea uliginosa*.*]

The variety *spinulosa* has a stout decumbent somewhat tufted caudex, and nearly erect fronds, which grow from one to two or three feet high. In vernation the pinnae are

[*Lastrea spinulosa*]

convolute at the margin. The stipes is about as long as the leafy part of the frond, and clothed, sparingly except at the base, with obtusely ovate scales, which terminate in a little point, and are uniformly pale brown, and almost diaphanous. The fronds are bipinnate, oblong-lanceolate, several of the lower pairs of pinnæ being usually of about the same length, and placed at an acute angle with respect to the main rachis. The pinnules are detached, often distant, oblong, more or less deeply pinnatifid, some of the basal ones on the lower pinnæ being almost pinnate, and attached by their narrow stalk-like base, which is slightly decurrent; they become more and more decurrent towards the points of the pinnæ. One or two of the inferior basal pinnules on the lower pinnæ are considerably larger than the corresponding superior ones, giving these pinnæ an obliquely elongate triangular figure; the second pair of pinnæ exhibits a similar discrepancy, in a less degree; but the difference in the size of the pinnules is not equally marked in all cases. The lobes of the pinnules are sharply toothed or serrated, the teeth ending in short spinous mucronate points. The sinuous mid-vein sends off a branch to each lobe of the pinnule; these lateral veins are more or less forked, a venule leading to each serrature, terminating within the margin, the anterior one bearing a sorus which is situated just within the sinus of the lobe. The sori thus form a line on each side the mid-vein and slightly distant from it. In the larger pinnules, which are divided almost down to the mid-vein, each vein runs up the centre of a lobe, sending out another series of simple alternate venules, several of which bear a sorus. The sori are nearly circular, usually small and distinct, though often crowded, covered by a flat reniform persistent indusium, the margin of which is waved, quite entire, and without glands; sometimes they become confluent on plants growing in exposed situations. The fructification is usually but not always confined to the upper portion of the fronds.

The normal form of the species is a very local plant,

found only on boggy heaths. It has been found at Westleton and Bexley near Ipswich, in Suffolk; Bawsey heath near Lynn, Dersingham, Edgefield near Holt, Fritton near Yarmouth, and Surlingham Broad near Norwich in Norfolk; in Huntingdonshire; near Madely in Staffordshire; at Oxtun bogs and Bulwell marshes, Nottinghamshire; and on Wybunbury bog, Cheshire. *L. uliginosa* has as yet been recorded only from Epping, Bawsey, Holt, Surlingham, Oxtun, Wybunbury, and Woolston moss near Warrington, in all but the first in company with *cristata*. It has also been reported from Mucruss, Killarney. *L. spinulosa* is doubtless a widely distributed and not uncommon plant, but it has been so long confounded with *L. dilatata*, that its exact range is unknown. It seems to be uncommon in Wales, and is very rare in Scotland, the only Scotch specimens I have seen having been obligingly communicated from the neighbourhood of Brahan Castle, Dingwall, by Sir W. C. Trevelyan. This plant occurs both in marshes and in moist woods. All the forms occur in other parts of Europe.

This is a free growing and easily cultivated species, and being of a distinct erect habit, and bearing exposure well, it is very suitable for damp rock-work, the two former varieties being especially adapted for planting in an artificial bog at the foot of a piece of rockwork. They, however, grow well in any other situation suitable for ferns.

6. *Lastrea dilatata*, Presl.—Broad prickly-toothed Buckler Fern.—Fronds arched ovate or oblong-lanceolate or subtriangular, bipinnate with pinnate or pinnatifid serrated pinnules, the serratures spinose-mucronate; scales of the stipes lanceolate entire; indusium fringed on the margin with stalked glands:—

[I do not think that sufficient evidence has yet been obtained to bring the involved questions which arise as to the proper rank of

those ferns which have been separated from time to time from this variable species, to a satisfactory conclusion. I have therefore not attempted it, but have placed as varieties the various forms proposed as species by other writers on the subject, adopting for the most part, in substance at least, the definitions they have given, and leaving the whole subject open for further investigation.]

a.——: fronds lanceolate-ovate or subtriangular ovate, somewhat drooping, bi-tri-pinnate; scales of the stipes dark-coloured and opaque in the centre, with pale transparent margins.

LASTREA DILATATA, Presl: Bab. Man. 411.—LASTREA MULTIFLORA, Newm. 216: Florigr. Brit. iv., 113 (incl. β).—ASPIDIUM DILATATUM, Smth Fl. Brit. 1125: Swartz: Willdenow: Eng. Fl. iv. 280: Eng. Bot., 1461: Franc. 42.—ASPIDIUM SPINULOSUM, Swartz: Willdenow: Hook. and Arn. Fl. 571 (in part).—POLYPODIUM DILATATUM, Hoffmann.—P. ARISTATUM, Villars.—P. CRISTATUM, Hudson.—POLYSTICHUM MULTIFLORUM, Roth.—LOPHODIUM MULTIFLORUM, Newm. App. xviii.

β . collina: fronds narrow ovate, elongate at the apex, bipinnate; pinnæ distant; pinnules oblong rounded at the end, lobed in the lower pinnæ, the lobes serrated at their extremity, scales of the stipes few except at the base, broader upwards, with a darker central mark.

LASTREA DILATATA *var. collina*, Moore, ed. 1, 59.—LASTREA MULTIFLORA, *var. collina*, Newm., 222: Florigr. Brit. iv. 114.—LASTREA COLLINA, Newm., 224.—LOPHODIUM COLLINUM, Newm. App. xviii.

γ . Smithii: fronds narrowly subtriangular-elongate-ovate, bipinnate; pinnæ opposite horizontal distant; pinnules narrowly decurrent with the slender wing of rachis, oblong obtuse serrated, the serratures incurved; scales of the stipes dark two-coloured, and except at the base small narrow and scattered.

ASPIDIUM SPINULOSUM, Smith Eng. Fl. iv. 279, according to a specimen communicated as authentic by Mr. H. Shepherd.

δ. dumetorum: fronds broadly subtriangular ovate, bipinnate dwarf; lobes of the pinnules strongly serrated at the ends; scales of the stipes two-coloured but pallid.

ASPIDIUM DUMETORUM, Smith Eng., Fl. iv. 281.

ε. angusta: fronds linear-lanceolate bipinnate; pinnæ short deltoid, the inferior and superior pinnules of the lowest pinnæ very unequal; scales of the stipes two-coloured but pallid.

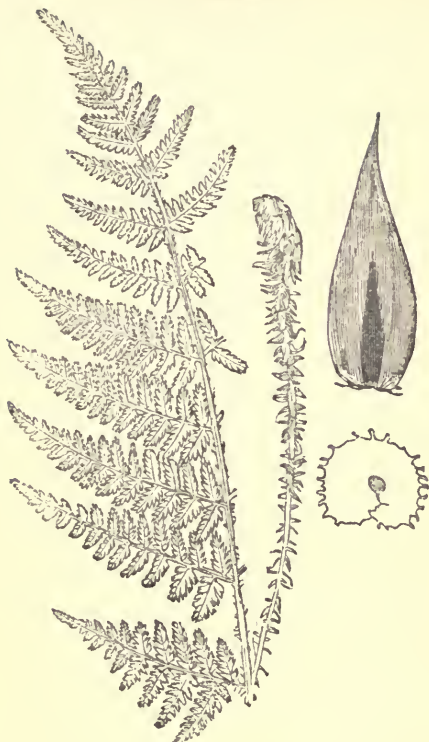
ζ. maculata: fronds oblong-ovate, with stalked glands beneath, most numerous along the ribs; bipinnate; scales of the stipes broad-lanceolate, whole-coloured, pallid.

LASTREA MACULATA, Deakin Florigr. Brit. iv. 110.

η. glandulosa: fronds lanceolate-ovate, or elongate-lanceolate, densely covered with stalked glands beneath, as well as on the stipes and rachis; scales of the stipes whole-coloured, pallid, broadly lanceolate-ovate.

LASTREA GLANDULOSA, Newman Phytol. iv. 258.—*LOPHODIUM GLANDULOSUM*, Newm. App., xviii.—*LOPHODIUM GLANDULIFERUM*, Newm. Phyt. iv. 371.

The Broad prickly-toothed Buckler Fern has a large tufted caudex, surmounted by a dense scaly crown, to which the fronds are terminal and adherent. The fronds vary from one foot or a foot and a half, to four or five feet in height, and assume when full grown a more or less curved or semi-drooping habit. The young fronds, which at the first are circinate in their veneration, are seen as they unfold, to be arranged differently in the upper part,



[*Lastrea dilatata*.]

the rachis being in fact folded laterally into two or three short lengths, while the extreme point is circinate. When quite young they are often but not always glandular, especially on the under side. The stipes in the full-grown plant, is very stout at the base, and there thickly clothed with lanceolate alternate sharp-pointed scales, which, in most of the varieties, are very dark coloured and opaque down the centre, paler and nearly transparent at the margins. The fronds are usually ovate-lanceolate in outline, but vary from almost triangular to almost lanceolate. The approach to the deltoid form, is perhaps confined to the fronds of young or starved plants, in which it certainly most frequently occurs. The fronds are twice or thrice-pinnate, the pinnæ standing in nearly opposite pairs, which are most distant from each other in the lower part of the frond. The pinnæ vary in form as well as in size, the longest measuring from three to six or in very large plants nine inches in length; and the lowest being often nearly triangular, broader as well as shorter than the three or four next above, the upper ones then becoming gradually narrower, and shorter; they are bipinnate below, and pinnate near the apex of the frond. The larger pinnules on the lower part of the frond are attached by a short slightly winged stalk, whilst those towards the point of the pinnæ, and in the upper part of the frond gradually become less distinctly stalked, and are finally decurrent. The inferior basal pinnules, especially those of the lower pinnæ, are much larger than the superior pinnules of the same pinnæ, and hence all the lower pinnæ acquire an oblique figure which is gradually lost in the upper part of the fronds. The pinnules are variously divided, more or less convex; those at the base of the pinnæ are almost or quite pinnate, further up they are more or less deeply pinnatifid, and towards the apex toothed; all the lobes are sharply serrate, the teeth ending in a short spine-like point. The venation—selecting a central pinnule from a central pinna—is arranged in this manner:—Each lateral

vein which branches from the mid-vein extends along one of the ulterior lobes, within which it ramifies, becoming more or less divided, as the lobe is large or small; the ramifications of this vein (venules) are alternate and simple, one of them running up the centre of each marginal tooth, the lowest anterior ones, and sometimes several others, bearing each a sorus a short distance from its extremity. The sori which are numerous, and appear scattered, are ranged on the more divided pinnules in two lines on each of its lobes crosswise the pinnule, just within the toothed margins of the lobes; but in the upper part of the frond, and also towards the apex of the pinnæ where the pinnules are less divided, they are ranged in two lines lengthways the pinnule near to the midvein. They are nearly circular, and are covered by an irregular reniform indusium, which is more or less fringed with stalked glands. The fructification is scattered over the whole under-surface of the fronds.

Under some conditions of growth this fern becomes remarkably convex, the fronds being arched, and every part more or less curved downwards. Starved plants assume a different aspect; they are smaller, more rigid, and of a dark brownish green colour, with the sori large and distinct, and having small, imperfectly developed, shapeless indusia, on which the glands usual to the species are but imperfectly developed. Mr. Newman has called this form *L. multiflora* var. *nana*.

The variety *collina* grows from a foot to a foot and a half high, with a pale-coloured stipes varying from one-third to one-half the entire height of the fronds. The stipes is furnished with narrow scales numerous below, but broader and more sparingly distributed above, and of a palish brown, darker in the centre. The outline of the fronds is stated by Mr. Newman to vary between deltoid and lanceolate, the latter being regarded as its perfect, and the former its immature condition. In specimens for which I am indebted to the Rev. G. Pinder, its discoverer,

the fronds are almost exactly ovate with the point elongated. They are bipinnate; and the pinnæ are distant, especially below, spreading, the first pair shortly deltoid, the next pair elongate deltoid, and the rest linear-lanceo-



[*Lastrea collina*.]

late, all having acute but not at all acuminate apices. The inferior pinnules of the lowest pinnæ are much larger than the superior ones, but in the rest of the frond the inferior and superior pinnules are nearly equal; they are obtusely ovate-oblong, a few of the basal ones narrowed to a broadish stalk-like attachment, the rest more or less confluent. The basal pinnules are all deeply pinnatifid, the lobes linear so blunt as to be almost truncate, and having several bristly-

pointed teeth mostly collected near their apices. The sori are borne over the whole frond, and except on the inferior pinnules of the lower pinnæ where they form two lines along the lobes, they are ranged in two lines along the

pinnules and near the midrib. The indusium is small and fringed with stalked glands. This fern has hitherto been certainly found only on the hills of Westmoreland, Lancashire, and Yorkshire; though it is suspected to occur in Ireland, about Powerscourt Waterfall in Wicklow, as I learn from C. C. Babington, Esq., and on the Dublin mountains, as has been hinted to me by Mr. J. R. Kinnahan. It is probably a distinct species. I have been favoured with other specimens collected at Coniston by Miss Beaver, who considers them identical with Mr. Pinder's plant; these have a much more leafy character than the specimens described above, as well as an irregularly jagged and crisped appearance, and they are abundantly glandular, and have very small distinct sori covered by convex indusia.

The variety *Smithii* I have described from a specimen sent to me by Mr. H. Shepherd of Liverpool, as being taken from part of the identical plant sent by Dr. Mackay to Sir J. E. Smith and described by him as *Aspidium spinulosum* in the *English Flora*. As it quite agrees with that description, it would appear to be the Spike Island plant, there mentioned. The frond is bipinnate, about a foot high, including a stipes of three inches, which is at the base clothed with long dark-coloured scales, and is furnished above with a few which are small and narrow. The pinnæ are opposite distant nearly horizontal, and but slightly unequal in the size of their superior and inferior pinnules. The pinnules are ovate-oblong obtuse, the basal ones pinnatifid with blunt lobes mucronately-serrated at the end; these basal ones have a narrow stalk-like attachment, but the rest are more or less decurrent. The sori form a line on each side of the midrib of the pinnules. This plant has some resemblance to the var. *collina*, and may possibly prove identical with it, which is the more probable since *collina* is supposed to occur in Ireland, as has been already mentioned.

The variety *dumetorum* is a dwarf plant, growing from six inches to a foot high, and having a sub-triangular-ovate outline. The suggestion that it is an immature though fertile condition of the ordinary form, is possibly correct. The fronds are bipinnate; the stipes short with two-coloured scales; the lower pinnæ unequal-sided; the pinnules ovate-oblong obtuse pinnatifid, having aristate-serrate lobes with the teeth mostly at the apex; the sori small distinct, ranged in a line on each side the midrib of the pinnæ, and covered by a thin flat involucre. This form or state of *L. dilatata* is probably of frequent occurrence though there are no exact or trustworthy records of its distribution.

The variety *angusta* I have seen but from one locality. In the narrow-elongate outline of the frond it quite corresponds with *L. spinulosa*, but the scales of the stipes are totally unlike those of that species. The fronds are about two feet long including the stipes which is nearly half of the entire length. The scales are moderately abundant on the stipes, and are large attenuately lance-shaped, palish brown but distinctly marked with a darker central bar. The frond is narrowly-linear-lanceolate, bipinnate. The pinnæ about three inches long, shortly deltoid, with a somewhat attenuated apex, distant especially below, the inequality of the superior and inferior pinnules very marked in the first second and third pairs of pinnæ but becoming less obvious above. The pinnules have mostly a short stalk-like attachment, and are linear-oblong, obtuse, very deeply pinnatifid with ovate or oblong incised or serrated lobes margined with spiny teeth. The sori are small but very abundant, and are covered by convex indusia which are very indistinctly glandular. It was found by the late Miss Bower, near Tunbridge Wells.

The variety *maculata* grows about a foot and a half in height, including the stipes, which is about as long as the frond, and is thickly clothed with lanceolate pointed scales, of a uniform brown colour. The colour of the frond is

dark green becoming spotted with irregular purplish blotches, and it is sprinkled on the lower surface with sessile or stalked glands, which are most numerous along the veins near the base. The frond is bipinnate; the three or four lowest pairs of pinnæ are elongate-deltoid and of nearly equal length—the rest are lanceolate. The pinnules are stalked, lanceolate, the lobes oblong ovate, deeply serrated with acute spinous teeth. The sori are borne immediately below the angle of the cleft which separates the lobes, on the anterior venule of each fascicle, and are covered by an unevenly margined indusium, which is mostly fringed with stalked glands. It was found by Dr. Deakin on the top of Goatfell mountain, in the Isle of Arran.

The variety *glandulosa* is a stout growing plant, two to three feet high, lanceolate-ovate, bipinnate; the stipes, which is about one-third of the entire length, being furnished with few very broad light brown scales without any darker coloured central bar. The pinnæ are elongate-deltoid, six inches long, densely covered on the under surface with glands, which are also so numerous on the stipes and rachis as to render it roughish to the touch. The pinnules are ovate acute, very deeply pinnatifid and coarsely serrated, the teeth ending in a spinous point. The sori are borne over the entire frond, in two series either lengthwise the pinnules or lengthwise the larger lobes of the pinnules, and they are covered by gland-fringed indusia. This variety, which was found in the forest of Dean in Gloucestershire by Mr. W. Bennett, and for which I am indebted to Mr. W. H. Purchas, is quite intermediate between the ordinary *L. dilatata* and *L. spinulosa*, and is perhaps as nearly related to the latter as to the former.

It is probable that several of the above forms of *Lastrea dilatata* are abundantly distributed over Great Britain, throughout which the species itself is found commonly in sheltered hedge-banks, or in moist woods among vegetable earth, under which latter circumstances it attains its

greatest degree of luxuriance. It appears to be also common on the Continent of Europe and in North America.

This species is of free growth, and easy culture, suitable either for rock work, shady borders, or wilderness scenery. It is one of the most compound and elegant of our native species, and though it may be grown fully exposed, yet it succeeds better in the shade.

7. *Lastrea fœnisechii*, Watson.—Hay-scented, or Triangular prickly-toothed Buckler Fern.—Fronds curved triangular tripinnate; pinnules pinnatifid, with serrated spinose-mucronate lobes; scales of the stipes concolorous, lanceolate, deeply laciniate; indusium margined with minute sessile glands.

LASTREA FŒNISECHII, Watson Phytol. ii. 568: Bab. Man. 411: Florigr. Brit. iv. 117.—*LASTREA RECURVA*, Newm. 225.—*NEPHRODium FŒNISECHII*, Lowe. *ASPIDIUM DILATATUM*, var. *RECURVUM*, Bree.—*A. RECURVUM*, Bree.—*A. DILATATUM*, var. *CONCAVUM*, Babin-
gton.

The Hay-scented Buckler Fern has a large tufted caudex, with a broad crown and numerous roots. The fronds, which are terminal and adherent to this caudex, are persistent, the old ones remaining fresh until after the young ones are produced in the following year, which occurs about May; they are at first regularly convolute, and in the partially developed condition the larger size of the lower pair of pinnæ is remarkably manifest. They vary from one to two feet—seldom if ever more, in height, are of a pale-green colour, and have when fully developed a graceful drooping habit, and a remarkably crisped appearance, caused by each of the lobes of the pinnules being concave, its edges and spiny teeth being curled upwards. They are covered with minute nearly globular sessile glands, and have, when dried, a fragrance like that of new hay. The stipes varies from a third to one half of the entire height, and is dark coloured and rigid, and clothed with long narrow laciniated pale-brown concolorous scales

of small size, most numerous at the base. The frond is bipinnate, and deltoid, or rather elongate-triangular, the lowest pair of pinnæ being much larger and longer than



[*Lastrea fœnisecii*.]

the rest, which gradually become smaller towards the apex; all the lower ones being distinctly stalked. The pinnæ are bipinnate, the basal pinnules being stalked, those towards the apex becoming decurrent. The first inferior pinnules on two or three of the lowest pinnæ is considerably enlarged, those of the lowest pinnæ most so, the other pinnules becoming shorter towards the apex; so that all the lower pinnæ have a triangular outline, the lowest being broadest. The lowest basal pinnules are divided first into ovate-oblong secondary pinnules, of which the lower are stalked and the upper decurrent, and the largest of these are again divided almost down to their midrib into oblong serrated lobes. The pinnules towards the apex of the pinnæ are cut into oblong serrated lobes, and those quite at the apex are decurrent, and deeply toothed. All

[*Lastrea fœnisecii*] the lobes are sharply serrated, the teeth everywhere ending in a short spinous mucronate point. The venation—selecting for examination a central pinnule from one of the central pinnæ—is thus arranged:—There is a medial dark-coloured midvein; from this the veins proceed alternately one to each lobe, and branch off into about two or three venules, one of which extends towards each tooth, but terminates before reaching it, the basal anterior venule bearing a sorus some distance from its extremity, and just beneath the sinus of the lobe. These pinnules therefore bear two lines of sori, one on each side their midvein, and at some distance from it. On all the larger pinnules the sori are biserial on the secondary pinnules and lobes, so that the sori are abundantly and nearly equally distributed over the whole under surface of the frond. They are covered by small reniform indusia,



which are jagged and uneven on the margin, and fringed with minute globular sessile glands.

This fern is very abundant in Ireland, where two forms of it would appear to be met with, and it occurs abundantly in Cornwall and Devon, and more sparingly in the counties of Sussex, Merioneth, Cumberland, and North Lancashire. It is also found both in the East and West Highlands, and in the Northern and Western Isles. The same species is plentiful in Madeira and the Azores. It occurs both in warm sheltered woody places, and on exposed as well as sheltered hedge banks, preferring moisture, but also sometimes found in dryish situations.

As a cultivated plant *Lastrea fœnisecii* is one of the most beautiful of all the British species, as its moderate size, delicate colour, crisped appearance, and gracefully pendulous habit amply testify; added to which its perfectly evergreen character greatly enhances its value. When protected from severe frost its fronds remain quite fresh through the winter, and do not decay until after young ones are produced the following year. This feature renders it a charming fern for the greenhouse or Wardian case. It will grow freely in the soil already recommended for ferns generally, and should have a liberal share of well-drained pot room, a moderate degree of shade, and a calm moist atmosphere. If not otherwise protected against frost, it would be the better sheltered in winter by having the pots plunged in ashes, sawdust, or old tan, in any convenient situation.

GENUS VIII.

ATHYRIUM, Roth.

GEN. CHAR.—*Sori* medial, short, oblong or sublunate, attached along the inner side of the venule; often arcuate or horseshoe-shaped and then continued across them. *Indusium* of the same form as the sorus, opening along the side next the mid-vein, its free margin fringed with capillary segments, at length reflexed. *Veins* free mid-vein distinct; venules branched.

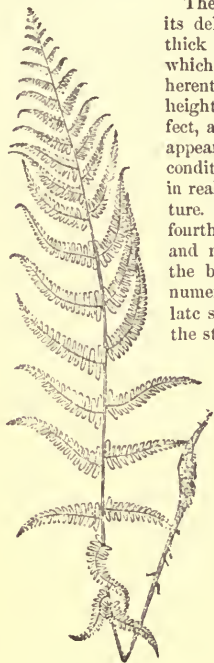
This genus, of which the beautiful Lady Fern is the type, is sometimes made to include all the *Aspleniums* having short oblong sori; others merge it in *Asplenium*, from which, however, those species, with fragile annual fronds, and fringed indusia, appear distinct.

The name is derived from the Greek *athyros*, opened; in allusion to the turning back of the indusium.

1. ***Athyrium rhæticum, Roth.***—Erect Lady Fern.—Fronds narrow-lanceolate, somewhat rigidly erect, bipinnate; pinnae distant, convex; pinnules distinct, linear acute, deeply pinnatifid, the lobes incurved; sori very short and numerous, near the midrib, becoming confluent.

ATHYRIUM RHÆTICUM, Roth: Newm. Nat. Alm. (1844), 26.—ATHYRIUM FILIX-FÆMINA, *var. CONVEXUM*, Newm. 245: Bab. Man. 413.—ATHYRIUM FILIX-FÆMINA, *var. RHÆTICUM*, Deakin

Florigr. Brit. iv. 60.—*POLYPODIUM RHÆTICUM*, Linnæus (fide Linn. Herb.). — *ATHYRIUM CONVEXUM*, Newm. App. xiii.—
— *ASPIDIUM IRRIGUUM*, Smith Eng. FL iv. 283: Eng. Bot. t. 2199, is the young state of this plant.



[*Athyrium rhæticum*.]

The Erect Lady Fern produces its delicate green fronds from a thick short tufted caudex, to which they are terminal and adherent. They grow erect to the height of from one to two or three feet, and have a somewhat rigid appearance owing to the curled up condition of the pinnules, though in reality of a soft herbaceous texture. The stipes is short, one-fourth of the height or less, black and much thickened just above the base, and there clothed with numerous dark-coloured lanceolate scales; the scales higher up the stipes become much narrower

and fewer, and they are continued sparingly along the stoutish rachis. Both stipes and rachis are not unfrequently strongly tinged with dull purplish red. The outline of the frond is narrow lanceolate, the lower pinnæ being more distant, as well as shorter and deflexed. The pinnæ are three or four

inches long, broadest at the base, gradually narrowing towards the acuminate apex. The pinnules are set quite distinct along the narrow secondary rachis, which is not winged, and they are usually set on nearly at a right angle with it. Their apparent form, in consequence of the rolling in of the points of the lobes, is linear, but in reality they narrow upwards from a broad base to the acute apex, and have a considerable enlargement of the anterior basal lobe, the anterior basal pinnule being moreover enlarged to a degree equally marked. They are cut in a pinnatifid manner into numerous linear lobes, the lower of which are notched with from five to seven teeth, the lobes becoming gradually smaller with fewer teeth towards their apex; the teeth being in almost all cases rolled under, and thus giving to the pinnules their remarkably narrowed and convex appearance. The veins proceed one into each lobe, and there branch into a number of simple alternate venules equalling the teeth on the margin. The lower anterior venule of each lobe bears a sorus, which is placed near the midrib, more than one sorus however being borne by the enlarged lobe. The sori, which thus form a line on each side the midrib, are very short and broad, and at length become confluent covering the under surface of the pinnules.

This does not appear to be an uncommon fern, though from its not having been generally discriminated from the other Lady ferns, there are no complete statistics of its range. It appears, however, to be recorded from the following provinces:—Peninsula, Channel, Thames, Severn, North Wales, Humber, East Lowlands, East and West Highlands, and some parts of Ireland; and is probably general in its distribution. It is found also in some other parts of Europe.

2. *Athyrium Filix-fœmina*, Roth.—Drooping Lady Fern.—Fronds lanceolate or broad lanceolate bipinnate; pinnules flat, oblong-lanceolate, deeply pinnatifid; sori

irregular crowded. A most variable plant, of which the following forms occur:—

a.—Fronds broadly lanceolate semi-drooping; pinnæ distinct; pinnules linear-lanceolate or ovate-lanceolate with flat diverging toothed lobes.

ATHYRIUM FILIX-FÆMINA, Roth: Newm. 420: Bab. Man. 413.—ATHYRIUM FILIX FÆMINA *var.* INCISUM, Newm. 243.—ATHYRIUM INCISUM, Newm. App. xiii.—ASPLENIUM FILIX-FÆMINA, Bernhardt: Hook and Arn. Fl. 574: Florigr. Brit. iv. 57: Franc. 50.—ASPIDIUM FILIX-FÆMINA, Swartz: Sm. Eng. Fl. iv., 282: Eng. Bot. t. 1459 (bad).—POLYPODIUM FILIX-FÆMINA, Linnæus.—POLYPODIUM INCISUM, Hoffman.

β. latifolium.—Fronds lanceolate flaccid; pinnæ approximate; pinnules stalked flat imbricate ovate, lobed at the base, toothed above; sori uniserial on each side of and distant from the midrib.

ATHYRIUM FILIX-FÆMINA *var.* LATIFOLIUM, Bab. Man. 413.—ASPLENIUM FILIX-FÆMINA, *var.* LATIFOLIUM, Moore and Houlston in Gard. Mag. Bot. iii., 262: Hook and Arn. Fl. 574.—ATHYRIUM LATIFOLIUM, Bab. MS., *not* Presl.—ATHYRIUM OVATUM, Newm. App. xii., *not* Roth.

γ. molle.—Fronds broadly lanceolate, lax; pinnæ approximate, the lower pair, short distant deflexed; pinnules oblong, connected at the base by the wing of the midrib, flat toothed; sori uniserial on each side of and near to the midrib.

ATHYRIUM FILIX-FÆMINA *var.* MOLLE, Newm. 242: Bab. Man. 413.—ATHYRIUM MOLLE, Roth: Newm. Nat. Alm. (1844), 26. and App. xii.—ATHYRIUM TRIFIDUM, Roth.—ASPLENIUM FILIX-FÆMINA *var.* MOLLE, Deakin Florigr. Brit. iv. 59.—POLYPODIUM MOLLE, Schreber.—POLYPODIUM TRIFIDUM, Hoffman.

δ. marinum.—Fronds lanceolate spreading, equally attenuate towards the base and apex; pinnæ approximate;



[Athyrium Filix-fœmina.]

pinnules crowded oblong, connected at the base, with shallow lobes and teeth; sori short broad distinct, chiefly borne near the base of the pinnules.

ATHYRIUM FILIX-FÆMINA *var.* MARINUM, Moore in Pop. Hist. Brit. Ferns 91.

ε. *multifidum*.—Monstrous: fronds suberect lanceolate; their apex as well as the apices of the pinnæ symmetrically multifid-crisped in a corymbose manner; sori crowded, confluent

ATHYRIUM FILIX-FÆMINA, *var.* MULTIFIDUM, Moore in ed. 1.—ATHYRIUM FILIX FÆMINA *var.* VIVIPARA, Steele Handbk. Field Bot. 215.—ATHYRIUM FILIX FÆMINA *var.* FURCATUM, of gardens.

ζ. *ramosum*.—Monstrous: fronds suberect divided at the apex into numerous narrow rachiform segments; pinnae small unequal and unsymmetrically lacerated at their apices; sori small, chiefly confined to the pinnæ.

ATHYRIUM FILIX-FÆMINA *var.* RAMOSUM, Moore and Houlston in Gard. Mag. Bot. iii. 262.

η. *crispum*.—Monstrous, dwarf; fronds with an irregularly branched rachis, the apices of the divisions dilated and multifid-crisped; sori small, scattered over the whole under surface, often wanting.

ATHYRIUM FILIX-FÆMINA *var.* CRISPUM, Moore in ed. 1.

The Drooping Lady Fern grows with a stout tufted caudex, which in old plants sometimes becomes considerably elongated and trunk-like, but is usually decumbent. The fronds which are of delicate texture, with more or less of a light feathery appearance, and are terminal and adherent to the rhizome, grow up about May, reach their mature condition towards the end of the summer, and die down naturally in the autumn if not previously destroyed

by early frosts. In veneration they are eireinate, but as they unfold, the apex by degrees becomes liberated, and hangs down, giving the half developed fronds the appearance of a shepherd's crook. The fronds grow around the crown, in vigorous plants often to the number of twenty or thirty, such examples being noble, as well as lovely. The outline is lanceolate. The stipes, which varies from a fourth to a third of the height, is clothed with numerous elongated scales around the base, where it is much swollen, a few smaller scales occurring higher up. The pinnae vary considerably in disposition, being either closer or more distinct, according to the situation in which the plant has been growing; they are three to six inches long, lanceolate, more or less attenuated from a broad base, distinctly pinnate, the pinnules becoming more or less decurrent in some of the varieties. The pinnules are



[A. F. f. crispum]

oblong, sometimes approaching to lanceolate, acute, flat, deeply pinnatifid; the anterior basal lobe larger than the rest; the lobes variously toothed, usually bi or tridentate towards the base, merging into simply toothed towards the apex. The venation is very distinct,

from the delicate texture of the frond. In average specimens the mid-vein is waved, the veins being forked shortly after leaving it; the anterior venule bearing on its anterior side the oblong sorus, which is ranged somewhat nearer the mid-vein than the margin; the other venule becomes forked or not, according to the composition of the frond, one branch extending to each serrature. In the larger and more divided pinnales, where the veins branch alternately, and bear more than one sorus, the latter appear very irregularly disposed. The sori are oblong, subulate, or elongate-reniform, and they are covered by an indusium of the same form, opening towards the mid-vein, its free margin split into narrow capillary segments. Sir J. E. Smith remarks that the sori finally become nearly round, and the indusium orbicular, with a notch at the base, thus assuming the character of an *Aspidium*, which view led him to refer this plant to that genus; but these are only instances, of frequent occurrence indeed, in which the sorus is continued across the vein and returned on the other side, so as to acquire the form of a horseshoe, various degrees of which, along with the linear form of sorus, may be found in almost every plant of this and the allied species.

The variety *latifolium* is a very distinct-looking plant, differing at first sight in its narrower and more elongated outline, and in the inequality and densely crowded condition of the pinnales. The more special differences occur in the form and uneven toothing or laciniation of the pinnales, and in the situation of the sori. The fronds are three feet or upwards in height, elongate-lanceolate, bipinnate, flacid, dark green. The stipes is short, and, as well as the rachis, stout, the lower part of the rachis being furnished with a few scattered narrow scales. The pinnae are alternate, approximate on the upper part of the frond, distant below, about four inches long at the broadest part of the frond, linear-lanceolate, tapering to a sharp point. The pinnales are ovate, blunt or sometimes acute,

unequal—that is, the anterior side largest, flat, stalked, and so closely placed that they overlap in every part of the frond; they are laciniate at the base, the lobes being oblong and irregularly toothed, and towards their apex become simply toothed, the teeth usually but unequally taper-pointed. The veins (as well as secondary rachis) are coloured red; in the lobed portion of the pinnule they branch into as many simple venules as there are teeth to the lobe; the lowest anterior venule which issues at some distance from the base of the vein, bearing a sorus, which is usually placed very near the point of forking; the veins are nearly or quite simple, in the upper or toothed portion of the pinnules. The sori are oblong, very frequently curved or areuate, and ranged in a row on each side the midrib, at the distance from it of about their own length. This form has been found near Keswick by Miss Wright, and, according to Mr. Newman it was gathered by Miss Beever also; but I learn from this lady that the habitat whence she supposes it must have been obtained is destroyed. I am indebted to C. C. Babington, Esq., for an authentic specimen, to which the preceding description applies.

The variety *molle* is the smallest and least divided normal form of Lady Fern. The fronds are generally from foot to a foot and a half in height, evenly lance-shaped, bipinnate or sub-bipinnate, flaccid, and of a bright green. Sometimes the pinnae are only pinnatifid, and the plant is moreover variable in size. In its larger and somewhat more divided state it is the *Athyrium trifidum*. The pinnae are taper-pointed, broadest at the base, about three inches long, approximate above, the lower ones being distant, blunter, and the lowest scarcely exceeding an inch in length. The pinnules are oblong obtuse, the lowest anterior ones being longest, flat, rather closely placed, and more or less connected by their decurrent bases. They are cut into oblong lobes, toothed principally at the extremity. The sori are short, subrotund, and placed so near

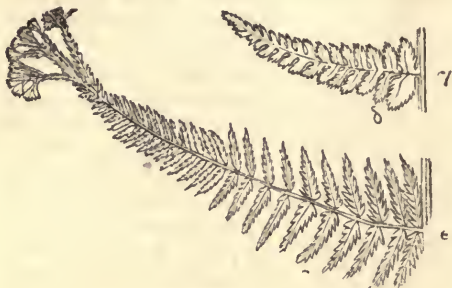
the midrib that they soon coalesce so as to cover it. This variety is frequent in shady places.



[A. F.-f marinum.]

The variety *marinum* possesses many of the characteristics of *molle*, but it differs in its spreading sub-decumbent habit of growth, its very much narrowed base, and its crowded scarcely lobed pinnules. The fronds are from twelve to fifteen inches long, exactly oval-lance-shaped, the base being narrowed equally with the apex, hardly bipinnate. The pinnae in the widest part measure an inch and a half, or two inches, and are linear-oblong, narrowing into a short scarcely acuminate point. The pinnules are largest next the rachis, oblong, very obtuse, and very closely placed, or slightly over-lapping; the margin is rather toothed than lobed, the lobes being seldom more than blunt simple or somewhat retuse notches. The sori are very short lunate, or arcuate, two to four pairs on a pinnule, scarcely becoming confluent. This variety has a distinct aspect, which it retains under cultivation. It was found in 1846 by Dr. Dickie in a sea-cave near Aberdeen, in company with *Cystopteris Dickieana*, and I am indebted for specimens and plants obtained from this source, to Mr. J. B. Mackay.

The variety *multifidum* grows from one to two feet high, and is chiefly remarkable for the elegant and symmetrical way in which the apices of all the pinnæ and of the frond itself become developed in a corymbose manner



[A. Filix-fœmina f and ε.]

into a tassel-like tuft. The frond, pinnæ, and pinnules are otherwise quite normal, the latter being narrow and elongate, distinct, and deeply cut into narrow lobes, as occurs in *Athyrium rhæticum*. Indeed, were it not for the width of the frond, this might perhaps be more correctly considered as a form of that species. The sori are subrotund, placed very near the midrib, and finally confluent. It is of Irish origin, and was first found by Mr. D. Moore, and subsequently by others. Its peculiarities are perpetuated in plants raised from the spores.

The variety *ramosum* grows about a foot high, and is somewhat like the last; but in this the apex of the frond is much more compoundly divided, and the pinnæ are greatly and unequally reduced in size, the consequence of which is a total loss of symmetry in the frond. It is divided at the apex into numerous narrow branching

rachiform segments. The pinnæ are small, unequal, and irregularly lacerated, with a bluntly-toothed margin. The sori are small, and are chiefly confined to the pinnæ, not occupying the rachiform segments of the apex. It was found in Ireland by Dr. J. T. Mackay.

The variety *crispum* is a dwarf and very distinct-looking plant, having the appearance of a dense tuft of curled parsley. The fronds are slender, from six inches to a foot long, and have no definite form, the rachis being irregularly and unequally branched with the apex of the divisions densely tasselled or tufted. It does not usually bear fructification, but when it does so, small and imperfect sori are scattered throughout the entire under surface. This form was first met with by Mr. A. Smith on the hill Orah, Antrim, Ireland, and has since been found in Bræmar in Scotland, by Sir W. C. Trevelyan.

Another monstrous fern, usually referred as a variety to *Athyrium Filix-fœmina*, and known in gardens under the name of *præmorsum*, I have not ventured to include in the foregoing enumeration, in consequence of its not having, as far as I am aware, been known to produce fructification. It was found by Dr. Dickie on Ben-na-Muich-dhu, at an altitude of 2,700 feet, in 1846, and has since that time proved constant under cultivation. It grows about six inches high, with unequal pinnæ, the pinnules decurrent, irregular in size and outline, and very irregularly lacerate-toothed.

The species is abundant in most parts of Britain, and particularly so in Ireland. Warm moist woods and hedge-row banks, are its favourite localities; but it is not confined to such situations, although in them it attains its greatest luxuriance.

“———Supreme in her beauty, beside the full urn,
In the shade of the rock, stands the tall Lady Fern.”

The Lady Fern is recorded to grow also throughout Europe, and very closely related, if not identical, species are met with in Asia and North America.

This fern does not appear to be applied to any special use, except that, in Ireland, where it abounds on all the bogs, it is employed as a packing material, as the common braeken is in this country.

This very beautiful plant is of all wild ferns one of the easiest to cultivate. When placed about rock work, it should occupy a low boggy situation at the base of the rock, being planted amongst turfy soil, kept thoroughly moistened, either naturally or artificially. It is far less beautiful if planted in dry exposed situations. Few hardy plants which can be introduced among rock work are so thoroughly lovely as a vigorous Lady Fern, placed just within the mouth of a cavernous recess, large enough to admit of its development, and just open enough that the light of day may gleam across the dark back-ground sufficient to reveal the drooping feathery fronds; and, what is more, it will delight to grow in such a situation, if freely supplied with moisture to its roots. In woodland walks, or on the shady margin of ornamental water, no fern can be more appropriately introduced. When grown in a pot, it requires one of rather a large size, and should be planted in turfy soil, intermixed with fragments of charcoal, sandstone, or potsherds. To attain anything like a fair degree of its lady-like gracefulness, this fern must under all circumstances be well supplied with water.

GENUS IX.

ASPLENIUM, *Linnaeus*.

SPLEENWORT.

GEN. CHAR.—*Sori* linear oblong or elongate, straight, attached along the inner side of the venules. *Indusium* entire or somewhat jagged, opening along its inner side, or that nearest the mid-vein. *Veins* free; *mid-vein* sometimes wanting; *venules* simple or forked.

This genus contains two groups, in one of which the pinnules or ultimate divisions have a distinct mid-vein, branching into simple or forked venules, along the inner side of which the sori are produced. In the other group there is no mid-vein, but the veins entering at the base of the divisions become more or less repeatedly furcate; the soriferous venules being fertile along their anterior or inner side. These differences have led to the separation of the latter group, for which Mr. Newman proposes the name of *Amesium*. *Asplenium septentrionale*, the typical species of this *Amesian* section, had, however, been long previously separated by Link, under the name of *Acropteris*. The distinctions of these groups, so obvious in the few species natives of Britain, are altogether lost among exotic species.

The name has been latinized from the Greek *asplenon*—that derived from *a*, priv., and *splen*, the spleen—a

term applied to some species of fern anciently employed as a supposed remedy in diseases of the spleen.

1. **Asplenium fontanum, Bernhardt.** — Smooth Rock Spleenwort.—Fronds linear-lanceolate, rigid, bipinnate, glabrous; pinnae oblong-ovate; pinnules small obovate-cuneate with a few large angular mucronate teeth; rachis winged throughout; sori short oblong.

ASPLENIUM FONTANUM, Bernhardt: Sm. Eng. Fl. iv. 299: Hook. and Arn. Fl. 574: Florigr. Brit. iv. 62: Franc. 48.—ASPLENIUM HALLERI, Brown.—ATHYRIUM FONTANUM, Roehl: Presl: Bab. Man. 413.—ATHYRIUM HALLERI, Roth.—ASPIDIUM FONTANUM, Swartz: Willdenow: Eng. Bot. t. 2024.—ASPIDIUM HALLERI, Willdenow.—POLYPODIUM FONTANUM, Linnæus.—POLYPODIUM PEDICULARIFOLIUM, Hoffman.

The Smooth Rock Spleenwort is an elegant little evergreen plant, with a short, thick, scaly tufted caudex, and wiry fibrous roots. The fronds, which are terminal and adherent to the caudex, are from three to six or eight inches high, erect, narrow lanceolate in outline, firm or rigid in texture, deep green and glabrous. The stipes is very short, with a few narrow pointed scales quite at the base; and the principal as well as the partial rachis has a uniform narrow winged margin. The fronds are bipinnate. The pinnae are oblong ovate, short and more distant towards the base of the fronds, and short but more crowded near the apex. The pinnules are obovate, tapering to the base, with from two to four or five—rarely more—deep notches, and as many sharp angular spinous teeth. The venation is rather indistinct, except when the fronds are young, owing to their rigid texture. The principal vein of each pinnule produces as many lateral veins as there are lobes or serratures, one being directed towards each marginal tooth. The sori, which are borne two or three on a pinnule, on some of the lower of the lateral veins or venules near their junction with the mid-vein, are short, oblong, sometimes distinct, but often be-

coming confluent, and occasionally occupying nearly the whole under surface of every pinnule, from the base to the apex of the frond; they are covered by an opaque white oblong indusium, more rounded on the free margin, which is turned towards the mid-vein, than on that by which it is attached, the free margin being also waved and somewhat indented.



[*Asplenium fontanum*.]

This species agrees in structure with *Asplenium lanceolatum*, notwithstanding the discrepancy of size in perfect specimens. Its claims to be regarded as a native plant have been much questioned, and its recorded habitats, one of which is Amersham Church, Bucks, have been searched in vain. There are specimens in the Herbarium of the Botanical Society of London, from Cavehill, Bel-

fast, communicated by Mr. Newnham; and others from rocks in Wharnccliffe Wood, Yorkshire, said to have been collected in 1838, by Mr Redhead. It is now and then reported from such suspicious localities as old garden walls, and was certainly found, in 1845, growing in company with *Asplenium Trichomanes*, on such an old high wall, connected with the mansion of the late D. Heigh, Esq., on Tooting Common, Surrey, where it could not have been introduced within half a century; but from this station it has since been era-

dicated by repairs of the wall. More recently, it has been found by the Rev. W. Hawker, on a wall at "Ashford," near Petersfield, Hampshire, where it is said to be growing in several large patches. Mr. Shepherd of Liverpool, who has been for many years a cultivator of ferns, has sent me specimens, which he states to have been gathered at Matlock in Derbyshire. The probability is that the plant has been often overlooked in its native haunts; and in confirmation of this view it may be mentioned that Mr. Hutcheson, formerly gardener at Boxley Abbey, Kent, and a fern cultivator, states that he gathered it in 1842 on rocks near Stonehaven, Kincardineshire, in a spot since destroyed by the construction of a railway. Undoubtedly many localities where it may exist have never been examined by a scrutinizing eye; and, as it is not unfrequent in other parts of Europe, especially the alpine districts, I do not feel justified in rejecting the testimony of our older botanists, and excluding, as others have done, this interesting plant from our flora.

Asplenium fontanum is a very pretty and easily grown plant. To ensure success, it should be carefully potted, so that superfluous moisture may drain away from its roots, and it is best elevated slightly above the level of the soil between two or three pieces of soft sandstone. It never attains a great size, and therefore does not require a large pot, and should be kept in a close shady frame. It may be propagated by division of the plant. This species grows admirably in a damp shady hothouse.

2. ***Asplenium lanceolatum*, Hudson.**—Lanceolate Spleenwort.—Fronds lanceolate, rigid, bipinnate glabrous; pinnae ovate-lanceolate; pinnules obovate, deeply and sharply toothed; rachis scarcely winged, minutely sealy; sori short oblong, near the margin.

ASPLENIUM LANCEOLATUM, Hudson: Sm. Eng. Fl. iv. 298; Eng. Bot. t. 240: Hook and Arn. Fl. 573: Bab. Man. 414: Newm.

249: Florigr. Brit. iv. 67: Franc. 49.—*ASPLENIUM* BILLOTII, F. Schultz.—*ASPLENIUM* ROTUNDATUM, Kaulfuss.—*TABACHIA* LANCEOLATA, Presl.



[*Asplenium lanceolatum*.]

The Lanceolate Spleenwort has a tufted caudex, densely covered with bristle-like scales, which scales, though of smaller size, are continued through the whole length of the stipes and rachis. The fronds are from four to eighteen inches long, and of proportionate width, growing sometimes nearly erect, in other cases drooping, variations which are, no doubt, dependent on the situations in which they are developed. Their texture is usually rigid, but, when developed in dark moist situations, it becomes more membranous. They remain persistent through the winter, and are terminal and adherent to the caudex. The stipes is from a third to one half the length of the frond. The outline of

the frond is lanceolate. The pinnae, which are pinnate—except in a young almost linear form of the plant in which they are only slightly lobed and one to two inches long—stand nearly at a right angle with the rachis, often, but by no means always, opposite, the lower ones being usually shorter than those about the middle of the frond, which are lanceolate. Occasionally,

however, the fronds are very nearly triangular in outline, when this species is not so readily distinguished from *A. Adiantum-nigrum*, from which, nevertheless, it may be known by the form and submarginal position of its sori. The pinnules are usually obovate, but vary considerably in form, being sometimes much attenuated at the base, with the apex rounded; sometimes blunt, both at the base and apex, becoming irregularly quadrate. In all cases they are indented on the margin with deep sharp teeth, the smaller pinnules being simply toothed and the larger ones near the principal rachis deeply cut and again toothed. The venation of each pinnule consists of a somewhat tortuous mid-vein, from which forked veins are produced, one venule extending to the point of each serrature. The sori are produced from the side of these veins and venules towards their extremity, without any regular order; they are at first oblong, but become more or less circular in age, the thin white indusium by which they are covered in their earlier stages being soon obliterated, the sori being often large, and frequently confluent when old. The indusium, which opens along its inner edge, is on that side usually slightly lacerated. The fructification is mature in August.

This species is not very abundant, and is chiefly found near the sea-coast. The counties from which it is reported are Cornwall, Devon, and Somerset; Gloucester, Kent, or Sussex; Pembroke, Glamorgan, Merioneth, Carnarvon, and Denbigh. It is also found in the Channel Islands, in the middle and south of Europe, in Madeira and the Azores; and, according to Link, in the west of Scotland near Gilphead, and in Ireland; but we do not find these latter statements confirmed.

It requires a mild sheltered climate, and is therefore not suited for rock-work, or exposed situations. Placed where it may have a moist and calm atmosphere, free drainage at the root, and a moderately elevated temperature, it will grow freely, and under such circumstances

is rather a handsome fern. The soil should be well intermixed with porous material to secure perfect drainage. It may be propagated by division, when more than one crown is formed.

3. **Asplenium Adiantum-nigrum**, *Linnaeus*.—

Black Spleenwort.—Fronds deltoid or ovate, bi-tri-pinnate; pinnæ triangular; pinnules ovate or ovate-lanceolate incise-pinnatifid, sharply toothed; sori linear-elongate, distant from the margin.

ASPLENIUM ADIANTUM-NIGRUM, *Linnaeus*: Sm. Eng. Fl. iv., 297: Eng. Bot. 1950: Hook and Arn, Fl. 573: Bab. Man. 414: Florigr. Brit. iv., 64: Franc. 49, Newm. 255.—ASPLENIUM NIGRUM, *Bernhardi*.—TARACHIA ADIANTUM-NIGRUM, *Presl*.—PHYLLOITIS LANCI-FOLIA, *Möench*.

β. obtusum; fronds smaller, less divided, the divisions more ovate obtuse; rachis winged.

ASPLENIUM ADIANTUM-NIGRUM *var. obtusum*, *Newm.* 258.—ASPLENIUM OBTUSUM, *Willdenow*.

γ. acutum; fronds tripinnate throughout; ultimate pinnules cut into linear sharply-toothed segments.

ASPLENIUM ADIANTUM-NIGRUM *var. acutum*, *Newm.* 259.—ASPLENIUM ACUTUM, *Bory*.—ASPLENIUM VIRGILII, *Bory*.—TARACHIA ACUTA, *Presl*.

δ. variegatum; fronds distinctly variegated with yellowish white.

ASPLENIUM ADIANTUM-NIGRUM *var. variegatum*, *Moore* in 1 ed.

The Black Spleenwort has a tufted caudex, furnished with wiry roots, and bristly scales, a few of which latter are scattered on the base of the stipes. The fronds, which are adherent to the caudex, and terminal, vary much in size; being sometimes not more than three or four inches



[*Asplenium Adiantum-nigrum*.]

in length, and sometimes as much as two feet. They appear towards the latter end of May, and reach maturity about September, remaining persistent through the winter. The stipes is smooth, shining, dark purple, almost black, about as long as, or, especially when vigorous, longer than the leafy portion of the frond. The fronds have a triangular, more or less elongated outline, the lower pair of pinnæ being always larger than the rest, and the apex of the frond often much attenuated. The pinnæ are pinnate, elongate-triangular, standing obliquely and more or less alternately on the rachis; the lower pair are from one to three inches long. The ovate or ovate-lanceolate pinnules also, especially those on the lower pinnæ, are pinnate, and stand obliquely and alternately. The smaller pinnules, and the lobes of the larger ones, are strongly, unequally, and more or less acutely toothed. The texture of the fronds, when mature, is for the most part rigid, and they assume an erect or pendent position, according to the conditions of the locality where they grow, which conditions also affect their size. The mid-vein of the pinnules is distinct. In luxuriant fronds the veins become secondary midveins, and in the most compound fronds, the lateral veins, or venules, sometimes become as tertiary mid-veins, the ultimate divisions of the frond, and all the principal lobes having mid-veins, from which proceed free alternate veinlets, either simple or branched, and on these, near the junction with the midvein, and on the inner side, the fructification is borne. The sori are distinct, linear, of considerable length, covered by a narrow white indusium, which bursts with an entire margin on the side towards its midvein, becomes at length forced aside, and is ultimately altogether pushed off. Being numerous, the sori frequently becomes confluent and cover the entire back of the frond.

The varieties *obtusum* and *acutum* differ from the ordinary condition of the species, on the one hand in the more blunt and rounded, and on the other in the more acute

and narrowed form of the frond, the pinnæ, and the pin-
nules. They are, however, closely connected by inter-
mediate states. The most distinct is *acutum*, which is a
remarkably ele-
gant plant. The
former is not un-
common in dry ex-
posed places. The
latter is chiefly
found in Ireland,
and in the western
counties of Eng-
land, and seems
rare. The variety
named *variega-
tum*, differs only
in its being, as its
name implies, dis-
tinctly variegated,
with yellowish
white. It was
found in 1847,
on Shottisbrook
church, Berkshire,
by Mr. Silver.

This species is
very common
throughout Eng-
land and Europe,
flourishing under
hedge-rows, in the crevices of rocks, and on the decay-
ing walls of ruined buildings.

The Black Spleenwort once had a reputed efficacy in
the treatment of coughs, asthmas, and similar affections
of the chest; but it has not maintained its reputation.

It is a very accommodating and ornamental species for
the cultivator, growing well under pot-culture, or planted



[*Asplenium Adiantum nigrum*—vars.]

on artificial rock-work. In the latter situation, its neat habit and glossy evergreen fronds render it very desirable. It may, too, be grown either in exposed or shaded situations; the chief difference being that, in the latter, it attains a greater degree of luxuriance. It is readily propagated by separating the crowns.

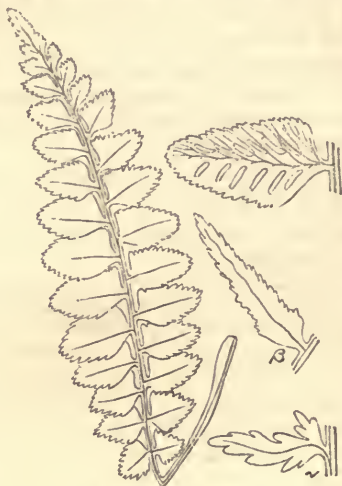
4. *Asplenium marinum*, *Linnaeus*.—Sea Spleenwort.—Fronds linear, or strap-shaped, pinnate; pinnæ ovate or oblong serrated, stalked, unequally wedge shaped at the base; rachis winged.

ASPLENIUM MARINUM, *Linnaeus*: Sm. Eng. Fl. iv., 294: Eng. Bot. 392: Hook and Arn, Fl. 573: Bab. Man. 414: Newm. 275: Florigr. Brit. iv., 69: Franc. 49.

β. acutum; fronds elongate; pinnæ narrow linear lanceolate elongate acute.

The Sea Spleenwort has a tufted scaly caudex, producing wiry roots, by which it is so firmly fixed in its native rocks as to be with difficulty removed. The fronds, which are terminal and adherent to the caudex, are pinnate, and of leathery texture, linear or linear-lanceolate, often much elongated, from two to twenty inches in length, the usual size being from six to twelve inches. The pinnæ grow in length after they become unfolded. The young fronds appear about the end of June, and remain fresh and green until long after new fronds are produced the following year; it is, therefore, truly evergreen. The stipes is smooth, varying from about one-sixth to one-half the length of the frond, and dark purplish-brown, almost black at the base, where a few narrow pointed scales are attached. The rachis is winged throughout. The pinnæ are stalked, serrated, and connected by the narrow wing of the rachis; they vary in form, usually between obtuse-ovate and oblong, the base being always very unequal, the anterior side being rounded and sub-auricled, the posterior side truncate. In

the variety *acutum*, the pinnæ take a much narrower and more acute and elongated form. The margin is crenately serrate, sometimes doubly crenato-serrate, occa-



[*Asplenium marinum*.]

sionally lobed. The venation is tolerably distinct, notwithstanding the leathery texture of the fronds; the mid-vein is prominent, and the venules become forked soon after leaving it, and bear on the anterior branch scarcely midway to the margin, a linear sorus which is covered by a pale-coloured persistent indusium, opening on the side towards the apex of the pinnæ. In some cases the sorus extends almost the whole length between the mid-vein

and the margin. The veins are somewhat thickened at the end, and terminate just within the margin. The fructification is mature in September and October.

This plant, though chiefly an inhabitant near the coast, has been found in two or three inland situations. It must, however, be regarded as a marine species, the fissures of sea-cliffs and the roofs of sea-caves being its favourite haunts. It is not uncommon on the rocky coasts of Great Britain and Ireland, and on those of the neighbouring islands; and occurs also on the coast of France and Spain, in North Africa, and in the Madeira and Canary Isles.

It appears to have been once used medicinally, for Ray recommends it in cases of obstruction, and states that its mucilage, applied externally to burns, is efficacious when other remedies have failed.

No one, as far as we are aware, has been successful in cultivating the Sea Spleenwort in the open air in the climate of London, exposed unsheltered to which it perishes. Whether or not, this be in consequence of its tenderness—requiring warmth, as indicated by its foreign habitats, or whether the peculiar saline influences of the sea are essential to it, as its almost universal position in a wild state might suggest, the probability seems to be that it is constitutionally tender, since it attains great luxuriance, when cultivated in the warm moist atmosphere of a shady stove. It, however, grows readily in a common frame kept closed. The plants are rather difficult to establish when newly removed from the rocks, their roots being of necessity much injured in the process of removal; but when once established, and placed in a sheltered position, they grow freely, and may be increased without difficulty by the ordinary process of division. Its evergreen habit renders it at all times ornamental. When cultivated in a common frame, it should have some protection against cold in winter; in fact, it is best placed

with other tender kinds, beneath a hand-glass kept closed in the greenhouse.

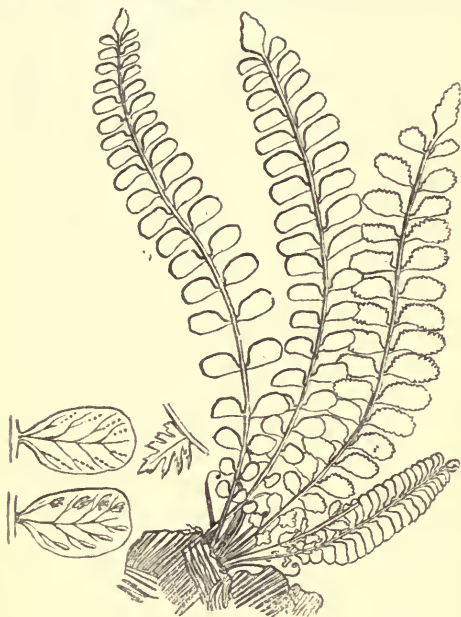
5. *Asplenium Trichomanes*, Linnæus.—Common Spleenwort.—Fronds linear pinnate; pinnæ roundish-oblong, crenated,^o stalked; rachis not winged, ebeneous throughout.

ASPLENIUM TRICHOMANES, Linnæus: Sm. Eng. Fl. iv., 292: Eng. Bot. 576: Bab. Man. 414: Hook and Arn. FL 573: Newm. 285: Florigr. Brit. iv., 73: Franc. 46.—ASPLENIUM TRICHOMANOIDES, Schkuhr.—PHYLLITIS ROTUNDIFOLIA, Mœnch.

β incisum: pinnæ deeply pinnatifid, with narrow inciso-serrate segments; barren.

The Common Spleenwort forms a dense tufted caudex, whose numerous wiry roots insinuate themselves in the crevices of the rocks and old buildings on which it establishes itself. The fronds are terminal, adherent, ever-green, the young ones appearing about May, numerous, narrow linear, simply pinnate, and from three inches to a foot in length. The stipes is very short, smooth, shining, purplish black, which colour is continued along the shining rachis. The pinnæ are numerous, about three lines long, opposite or alternate, stalked, roundish oblong, unequally wedge-shaped at the base, dark green, nearly entire on the margin, or usually more or less deeply crenated. In the variety *incisum* they are deeply but irregularly pinnatifid with linear-serrated segments. When the fronds become aged the pinnæ are readily detached, and they eventually fall off like the leaves of a deciduous plant, leaving the persistent rachis quite denuded. The pinnæ are usually quite distinct, but occasionally crowded; each has a distinct mid-vein, from which proceed alternate venules, which are forked near the base, the anterior branch bearing the sorus just beyond the fork, and both terminating within the margin. The linear sori are each covered by a thin pale-coloured membranous indusium of

the same form, which opens along the side towards the apex of the pinnae, and has its margin usually very slightly crenated; they are numerous, and sometimes be-



[*Asplenium Trichomanes*.]

come confluent, and cover the entire under-surface of the frond. The fructification is mature in August.

Besides the variety *incisum*, there is another accidental form of this species sometimes met with, in which the apex of the frond is two or three times dichotomously divided, with a tendency in the ultimate divisions to become multifid crisped. This occurs in some collections under the name of *monstrosum*. We have been favoured with specimens from St. Mary's Isle, Kircudbright, by Mr. D. Dick; and of a similar form from Quin Abbey, Clare, by Mr. J. R. Kinahan.

A commonly distributed species throughout the United Kingdom and Ireland, growing on rocks and old walls, and more rarely in hedge-row banks, where however it is more luxuriant. There is scarcely anything in the vegetable world more beautiful than a surface of wall covered with luxuriant specimens of this simple-looking fern. It is found throughout Europe, in Asia, and in Africa.

From the statements of the old writers, it would appear that this fern once had a medicinal reputation which it does not now possess. Ray speaks of it as useful in affections of the chest and lungs; and Lightfoot records that the Scotch country people, in his day, made from it a tea and a syrup, which were taken as remedies for coughs and colds. Some old medical books refer to this plant as the source from which the syrup called *Capillaire* is prepared.

This plant grows readily either on rock-work or in pots, but its roots, being wiry, and insinuated into the crevices of walls and rocks, it is often found difficult to transplant successfully. The smaller and younger plants should be chosen, and carefully taken up with as little injury to the roots as possible, and they should be kept in a close atmosphere for a few weeks after transplantation. It forms a very elegant little evergreen plant on rock-work, and grows freely when established if care be taken not to allow stagnant water to remain about its roots. From its small size, it should, of course, be placed in the more prominent situations in the rockery, where its elegant ap-

pearance may not be lost sight of. It is propagated by dividing the tufts when there is more than one crown. The young fronds spring up about April or May.

6. **Asplenium viride**, *Hudson*.—Green Spleenwort.
—Fronds linear pinnate; pinnae rhomboidal or roundish-ovate crenated stalked; rachis not winged green in the upper part.

ASPLENIUM VIRIDE, *Hudson*: Sm. Eng. Fl. iv., 293: Eng. Bot. t. 2257: Bab. Man. 414: Hook and Arn. Fl. 573: Florigr. Brit. iv. 71: Newm. 281: Franc. 47.—ASPLENIUM TRICHOMANES RAMOSUM, *Linnaeus*.

β. acutum: pinnae 'long and pointed' (*Newm.*).

The Green Spleenwort produces its fronds in a dense tuft from the caudex, which is dark coloured, somewhat creeping, and furnished with a few narrow pointed scales, producing also numerous slender wiry roots, by which it fixes itself to its native rocks. The fronds grow up in May, remaining green through the winter, and are narrow linear, pinnate, light green, and from two to eight or ten inches in length, according to the circumstances of exposure or shelter under which they have grown. They are terminal and adherent to the caudex, and, in a young state, are covered with fine, very deciduous scales. The stipes is smooth, usually about a third of the length of the frond, more or less purplish brown at the base, but otherwise green, the green colour being continued along the rachis to the apex. The pinnae, attached by slender stalks, are commonly, but not invariably alternate, and more distant in the lower than in the upper part of the frond; they vary considerably in form, between rhomboidal and roundish-ovate, usually tapering to the base, but sometimes broadest at the base, and much shortened and rounded at the apex; the margin is deeply crenated. Sometimes the apex of the frond is dichotomously or trichotomously forked. The mid-vein of the pinnae is dis-

tinged, sending off simple or forked venules, which seldom reach the margin: when forked, the forking is either beyond or opposite to the fructifications. Each sorus is linear, and at first covered by a narrow lanceolate membranous indusium, which has a jagged or crenate margin; this is soon pushed aside by the spore-cases, which not unfrequently become confluent over the under surface. The fructification is mature about August.

This species occurs, not very commonly, in the mountainous rocky districts of England, Wales, and Scotland, and less commonly in Ireland, delighting in the vicinity of waterfalls. It is found throughout the alpine and sub-alpine districts of Europe.

This is usually a free growing plant under cultivation, not, however, often attaining the size which it acquires in sheltered places amongst the moistened rocks, in the interstices of which its roots delight to insinuate themselves, often so firmly as to render it next to impossible to extricate the plants uninjured. It requires well drained pots, and soil intermixed plentifully with small lumps of broken freestone, and delights in a damp shady

situation, provided the moisture is not too nearly stagnant. In the rockery it needs shade and the shelter of a bell-glass, to protect it from the hot arid summer air, and the excessive wet of winter, which seldom drains away sufficiently from artificial rock work. The proper bell-glasses for these half-hardy ferns, are those having a small opening in the crown, which may be closed or not at



[*Asplenium viride*.]

pleasure, but is in general best left open in favourable weather. The plants may be propagated occasionally by dividing the tufted caudex.

7. *Asplenium Ruta-muraria*, *Linnaeus*.—Rue-leaved Spleenwort or Wall Rue.—Fronds deltoid bipinnate; pinnules obovate or rhomboid-wedge-shaped, toothed on the upper margin; free margin of the indusium jagged.

ASPLENIUM RUTA-MURARIA, *Linnaeus*: *Sm. Eng. Fl.* iv., 296: *Eng. Bot.* t. 150: *Hook and Arn. Fl.* 573: *Bab. Man.* 414: *Florist. Brit.* iv., 75: *Franc.* 45.—*ASPLENIUM MURALE*, *Bernhardi*.—*AMESIUM RUTA-MURARIA*, *Newman*, *Brit. F.* 10: *App.* viii.—*SCOLOPENDRIUM RUTA-MURARIA*, *Roch.*—*TARACHIA RUTA-MURARIA*, *Presl*.—*PHYLLITIS RUTA-MURARIA*, *Muech.*



[*Asplenium Ruta-muraria*.]

The Wall Rue is a dwarf tufted growing plant, producing tough wiry roots from its thick short caudex, which is clothed with bristly scales. The fronds are

numerous, terminal, and adherent to the caudex, deep green, from one to six inches in length, growing up in May and June, and continuing green through the winter. The stipes is smooth and slender, more than half the length of the frond, green except at the base, where it is blackish-purple. The frond is more or less triangular in outline, usually bipinnate, but sometimes in young or imperfect specimens, only pinnate. Very young seedling plants have the fronds simple and kidney-shaped, and in the next stage pinnate, with a single pair of roundish reniform pinnæ. The pinnæ of ordinary mature plants as well as the pinnules are alternate. The pinnules are rhomboidal, roundish ovate, or obovate with the base wedge-shaped, sometimes cuneate with the apex truncate; the upper margin is always irregularly toothed or notched, the wedge-shaped base entire. The ultimate divisions of the fronds, whether pinnæ or pinnules, are without a distinct mid-vein, but a series of veins arise from the base, becoming in their progress branched, and spreading outwards, the number of branches or venules usually corresponding with that of the marginal teeth. On the inner side of these venules the sori are produced, several on a pinnule; they are linear-elongate, covered by long narrow membranous indusia, which have their margin irregularly jagged or sinuated, and are soon obliterated by the spore-cases, which become confluent, and usually at length cover the entire under surface. The fructification is mature in August.

A very common species, found in the fissures of rocks, and more abundantly on old walls, exhibiting a predilection for brick walls. It is generally distributed over Europe, and is said to be not uncommon in some parts of North America. This fern was formerly reputed to possess pectoral qualities. The cuneate-truncate form above mentioned, somewhat resembles *A. Germanicum*, and is sometimes mistaken for it.

The Wall Rue grows better in fragments of old brick

and mortar than in soil, and requires less moisture and confinement than is generally congenial to this race of plants.

8. *Asplenium germanicum*, Weiss.—Alternate-leaved Spleenwort.—Fronds lanceolate linear, broadest at the base, pinnate; pinnæ alternate, narrow wedge-shaped, the lowermost three-cleft; margin of the indusium entire.

ASPLENIUM GERMANICUM, Weiss: Newm. 265: Bab. Man. 414: Florigr. Brit. iv. 77.—ASPLENIUM ALTERNIFOLIUM, Wulfen: Sm, Eng. Fl. iv., 296: Eng. Bot. t. 2258: Hook and Arn. Fl. 573: Franc. 44.—ASPLENIUM BREYNIi, Retzius. AMESIUM GERMANICUM, Newmann Brit. F. 10; App. vii.—SCOLOPENDRIUM ALTERNIFOLIUM, Roth.—TARACHIA GERMANICA, Presl.—PHYLLITIS HETEROPHYLLA, Mœnch.

The Alternate-leaved Spleenwort is a small delicate plant, having a tufted caudex, to which the fronds are terminal and adherent. The numerous fronds grow up in the spring, and flourish during the summer, but usually perish in the winter, so that the species is but sub-evergreen; they are from three to six inches high, narrow linear, somewhat widened at the base, pinnate, with distant, alternate, narrow, wedge-shaped pinnæ, which taper gradually at the base into a short slender stalk, by which they are attached to the rachis. The stipes is slender, about half the length of the frond, smooth, purplish at the base, the rachis being, for the most part, green. The pinnæ are ascending, toothed or



[*Asplenium germanicum*.]

notched at the apex, two or three of the lowermost having a pair of alternate lateral lobes. There is no mid-vein; the veins which arise from the base of the pinnæ becoming branched, and a branch extending towards each of the teeth into which the apex is divided. There are thus two to four or more subparallel longitudinal venules, two or three of which bear a linear-elongate sorus along their inner margin. The sori are covered by linear membranous indusia, having the free margin entire or sinuous "but not jagged; and they at length become confluent, obliterating the indusia. The fructification is mature in August.

One of the rarest of our native ferns, having been discovered only near Llanrwst in Carnarvon or Denbighshire, at Borrowdale in Cumberland, near Kelso in Roxburghshire, and at Dunfermline in Fifeshire, and Dunkeld in Perthshire. In the herbarium of Mr. S. F. Gray, there is a specimen of this fern, labelled as *A. septentrionale* from Arthur's Seat. It is found in other European countries, but is nowhere a common plant.

This rare fern is one which does not thrive under cultivation, except with careful management. If potted in porous soil, with the crown well elevated, and covered by a bell-glass in a shaded frame, or put in a warm close house or pit without a bell-glass, it will generally grow with vigour; but the plants are very liable to perish in winter. The safeguard is, not to allow water to reach their crowns, to keep their roots just moderately moist, and not to suffer the bell-glasses employed to protect them from the risk of being wetted, to injure them by retaining a constantly damp atmosphere, which they will do if they are kept permanently closed.

9. *Asplenium septentrionale*, *Hull*. — Forked Spleenwort.—Fronds linear, simple or two-three-eft, the segments alternate elongate; margin of the indusium entire.

ASPLENIUM SEPTENTRIONALE, Hull: Swartz: Sm. Eng. Fl. iv., 295. Eng. Bot. t 1017: Hook and Arn, Fl. 573: Bab Man. 414: Florigr. Brit. iv., 74: Newm. 269: Franc. 44.—AMESIUM SEPTENTRIONALE, Newman Brit. F. 10; App. vii.—ACROPTERIS SEPTENTRIONALIS, Link.—ACROSTICHUM SEPTENTRIONALE, Linnæus.—SCOLOPENDRIUM SEPTENTRIONALE, Roth.—PTERIS SEPTENTRIONALIS, Smith.



[*Asplenium septentrionale*.]

The Forked Spleenwort has a tufted caudex, often forming a comparatively large mass, and producing slender branched fibres which serve to fix it to the rocks on which it grows. The fronds which are terminal and adherent to the caudex are small and slender, often very numerous, from two to four inches long, dull green, except quite at the base of the stipes, which is dark brown-purple. Their usual outline is narrow

elongate-lanceolate from the partial spreading of the lateral segments, gradually diminishing downwards into the smooth stipes, which is about equal to the frond in length. The frond itself, in vigorous specimens, is cleft into two or three narrow segments: sometimes deeply cleft to the very rachis, the lobes narrowing downwards, and often having a bifid apex, and one or two short lateral sharp-pointed or bifid teeth; sometimes less divided, the lateral divisions merely forming enlarged bifid teeth; and sometimes still more reduced into mere teeth, the apex of the frond lengthened, but slender and curved. The lateral lobes,

therefore, appear either simply slit away from the main division, or they are so deeply divided and narrowed downwards as to assume the appearance of distinct pinnae. The veins are nearly simple, that which extends into each division of the frond proceeding directly from the base, and becoming forked upwards when the lobes are furnished with bifid teeth, one branch then extending to each tooth; most of these venules bear a sorus on the inner side. The central lobe of the frond has usually one venule paralld with, and near to each margin, and each of these venules bears a long narrow sorus attached to the inner side, the indusium opening by its inner edge. The opposite position of these veins, and proximity of the sori, which open face to face, produce some resemblance to the twin fructification of *Scolopendrium*; but the true nature of the sori is sufficiently evident in the earlier stages of development, when they are seen to be perfectly distinct, each having its own indusium. Each sorus is covered by a linear membranous indusium, the free margin of which is entire; this is pushed back by the spore-cases and finally lost, the sori becoming confluent and the entire surface covered by the spore-cases. The fronds are persistent through the winter, the young ones appearing about April. The fructification is mature in August.

This is a rare species, confined to the counties of Somerset, Carnarvon, Denbigh, York, Northumberland, Cumberland, Westmoreland, Roxburgh, Edinburgh, and Perth, and apparently not found at all in Ireland. It is however, not unfrequent throughout Europe, most common in the south, and is found in the mountains of Asia.

This and the preceding minute species require shelter, and constant but moderate and not stagnant moisture. In the climate of London they grow well in pots, in cold close frames, but do not bear exposure. The present species is somewhat tender, the young growth being liable to suffer from spring frosts.

GENUS X.

SCOLOPENDRIUM, *Smith.*

HART'S TONGUE FERN.

GEN. CHAR.—*Sori* linear elongate straight, growing in proximate parallel pairs on the anterior and posterior venules of adjacent fascicles of veins. *Indusium* linear-elongate attached to the venules on opposite sides of the proximate sori, the free margins being face to face, conniving when young, at length separating down the centre of the twin sorus, which becomes confluent into one linear mass of spore-cases. *Veins* two or three times forked; mid-vein prominent; venules parallel, free, their apices club-shaped.

This beautiful fern is one of the most prolific of varieties—some being very remarkable—of all our native species. On the ground that *Scolopendrium* was originally given as a specific appellation, and ought not therefore to be used as a generic title, Mr. Newman proposes to substitute the name of *Phyllitis* for this genus,—a change which is quite unnecessary, and based on arguments which, if followed out, must tend to bring the so-called law of priority in botanical nomenclature, into merited contempt.

The name is derived from *scolopendra*, the name of a genus of myriapods, to the feet of which the lines of fructification are supposed to bear some resemblance.

1. **Scolopendrium vulgare**, *Symons*. — Common Hart's Tongue Fern.—Fronds smooth, linear-lanceolate, or oblong-strap-shaped, cordate at the base; stipes shaggy with narrow membranous scales.

SCOLOPENDRIUM VULGARE, *Symons*: Sm. Eng. Fl. iv., 301: Eng. Bot. 1150: Hook and Arn. Fl. 574: Bab. Man. 415: Newm. 289: Florigr. Brit. iv., 78: Franc. 52. — SCOLOPENDRIUM OFFICINARUM, Swartz. — SCOLOPENDRIUM PHYLLITIS, Roth. — PHYLLITIS SCOLOPENDRIUM, Newman, Brit. F. 10; App. vi. — ASPLENIUM SCOLOPENDRIUM, Linnæus.

β. polyschides: fertile; fronds linear deeply and irregularly crenatolobate on the margin (fig. ♂, p 178). [PHYLLITIS POLYSCHIDES, Ray.]

γ. marginatum; fertile; fronds strap-shaped, the margin double, that is, with an excurrent membrane developed from behind near the margin, both it and the margin being lacerate-lobed and fertile.



[*Scolopendrium vulgare*.]

δ. hastatum; fronds strap-shaped, having a pair of angular spreading lobes at the base: *i. e.* hastate.

ζ. crispum; fronds strap-shaped, the margin much undulated, the base auriculate cordate; usually barren (fig. γ, p. 178).

η. lobatum; fronds oblong dilated at the apex and there cut into acute lobes (fig. β, p. 178).

θ. multifidum; fronds forked, often repeatedly towards the extremity, fertile: sometimes undulated and then barren.

[*PHYLLITIS MULTIFIDA*, Ray.]

ι. laceratum; fronds short, broad oblong-ovate, or obtusely sub-deltoid, the margin deeply inciso-lobate, the lobes large crowded and multifid-crisped at their apex; or sometimes strap-shaped, the margin inciso-lobate, with the lobes narrow elongate and tapering to a point; the apex submultifid, the base sometimes hastate.

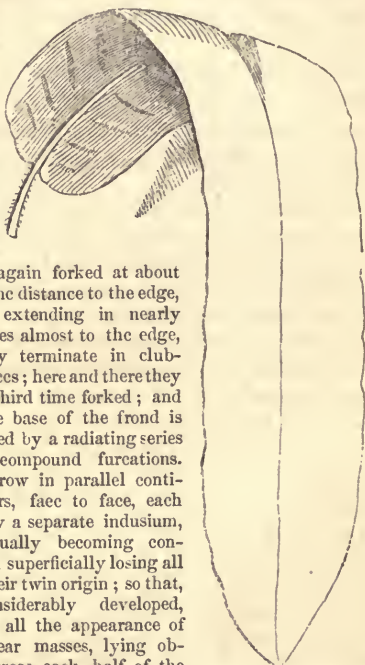
κ. ramosum; stipes branched, the branches of frond dilated at their apices and divided into numerous unequal crisped lobes (fig ε, p. 178).

The Common Hart's Tongue Fern has a compact tufted caudex, to which the fronds are terminal and adherent. The fronds are produced in the spring about April, and remain green through the winter; they are at first erect, but by degrees assume, more or less, a gracefully drooping habit. The stipes occupies about a third of the length of the fronds, and is of a brown purple colour, somewhat shaggy with narrow membranous pale-brown scales, which are also continued along the back of the mid-rib. The fronds are narrow elongate lanceolate, or oblong-strap-shaped, entire and plane on the margin, acute at the apex, cordate at the base, and varying from about six inches to

two feet in length. The texture is very succulent when young, becoming thickish and somewhat leathery when mature, full green above, somewhat paler beneath. A

series of bi- or tri-furcate veins branch out from the mid-rib, the first forking occurring close to their base, and the two branches

becoming again forked at about one-third the distance to the edge, and then extending in nearly parallel lines almost to the edge, where they terminate in club-shaped apices; here and there they become a third time forked; and the cordate base of the frond is always filled by a radiating series of more compound furcations. The sori grow in parallel contiguous pairs, face to face, each covered by a separate indusium, but eventually becoming confluent, and superficially losing all trace of their twin origin; so that, when considerably developed, they have all the appearance of simple linear masses, lying obliquely across each half of the frond. The two lines of spore-



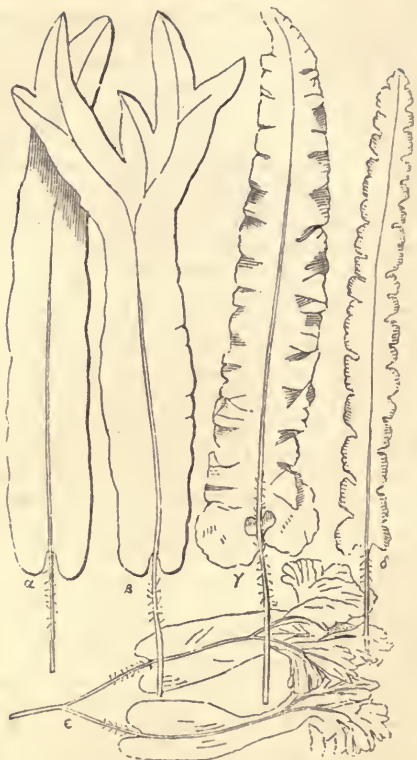
[*Scolopendrium vulgare*.]

cases arise from separate but adjacent fascicles of veins, one being attached to the upper side of the anterior branch of one, and the other line to the lowest side of the posterior branch of the next fascicle, and so on over the fertile portion which generally occupies three-fourths of the frond. They are each covered with a pale-coloured membranous indusium, which is so attached, that the free margin is exterior as regards the fascicle of veins to which it is attached; and, though at first touching each other, and opening therefore in opposite directions like a pair of folding doors, they are soon pushed back by the growing masses and lost, the double series of spore-cases becoming so united as to form one crowded line. The sori are of very unequal length.

There are numerous varieties of this fern, nearly all of which are more or less monstrous in their development. They are, however, for the most part very constant, and hence as they are really very different in their aspect, this species is one of the most valuable to the cultivator.

The variety *polyschides*, has the fronds six inches to a foot long, narrower than the common form, somewhat pinnatifid, and deeply and irregularly crenately-lobed on the margin; they are erect, and when very luxuriant have a little tendency to undulation, and are more or less fertile. The sori are short, oblong, or linear, very irregular.

The variety *marginatum*, is the most remarkable and the most beautiful of all the forms as yet known. The fronds grow erect, a foot or more in height, and stand in a circle around the crown; they are simple strap-shaped, the margin irregularly lobed, the under surface producing within the margin an excurrent membrane which is also lobed. Both surfaces of this membrane and the under surface of the frond itself exterior to it are soriferous. The fronds have therefore as it were a double margin. In the less perfectly developed condition, the membrane is reduced to the form of a longitudinal vein-like ridge. This variety was first found near Nettlecombe, in Somerset-

[*Scolopendrium vulgare*, v.ars.]

shire, by Sir W. C. Trevelyan, and subsequently near Selworthy, in the same county, by Mrs. Archer Thompson, to both of whom I am indebted for specimens. A curious form allied to this, having, however, the excurrent membranous line on the upper surface, has been met with by Mr. S. F. Gray; and this form if constant, it is proposed to name *supralineum*.

The variety *hastatum*, differs in having the base hastate, instead of cordate.

The variety *crispum*, is one of the handsomer forms, and quite constant. It is of the usual shape, but the margin is very much curled or undulated, from which peculiarity it has also obtained the name of *undulatum*; the base is auriculately cordate. It is usually barren, but sometimes fertile.

The varieties *lobatum*, *multifidum*, and *ramosum*, are more decided monstrosities. The first has the point of the fronds dilated, and more or less cut into acute lobes, and is not very constant. The second has the fronds forked more or less, often repeatedly near the extremity, all the divisions divided in a multifid manner at the apex; it is usually fertile, but sometimes comes undulated, and is then barren. The third has the stipes forked, and the branches dilated and multifidly crisped at their apices.

The variety *laceratum* is a curious and less constant form, grown in the Royal Gardens at Kew. Sometimes the fronds are short, almost as broad as long, very blunt at the apex, deeply and irregularly lobed in a pinnatifid way almost down the midrib, the lobes being crowded, imbricating and much undulated, each of them more or less dilated at the apex, and multifidly forked. The lower pair of lobes are sometimes almost distinct, and much enlarged, and sometimes the lobes are so developed as to produce an approach to the palmate form. In other cases the fronds are strap-shaped, the margins inciso-lobate, most of the lobes extended into a narrow taper-point. In some fronds the apex has a tendency to become multifid; some

of the fronds, not all, have the base hastate. This, which has been called *serratum*, is, probably, the usual form, as the broader and more lobate form was raised from its spores, and the plants have reverted to it. Both were cultivated at Kew, the plants having been received from Mr. Young, of Taunton.

The Hart's Tongue is one of our commonest native species, being almost universally distributed, occurring very abundant in Ireland, less abundantly in Scotland. It occurs on walls and ruins, on hedge-banks, among thick bushes, and in the interior of wells, in the latter situation acquiring extraordinary vigour. It is found all over Europe and in Asia. The varieties, though mostly originally found in a wild state, are not now often met with, and are chiefly known as cultivated plants.

The medicinal virtues for which the species was formerly in repute, are now disregarded. It was said to be used, boiled in red wine, as an astringent in cases of diarrhoea and hæmorrhage, and to form an ointment for the healing of wounds and ulcers. According to Lightfoot, it was in his day used by the Scotch rustics in the form of an ointment as a vulnerary, for burns and scalds.

It is a very distinct looking fern, and highly ornamental on rock work, from which neither the species nor its varieties should be absent. Indeed, the great variety it affords, and its evergreen habit, render it one of the most valuable of all ferns for the hardy fernery. It is, moreover, a very free growing plant, thriving in any situation, though acquiring its greatest perfection in shady humid places. As a pot plant it requires considerable scope for its roots. It is increased by dividing its crowns.

GENUS XI.

CETERACH, Willdenow.

SCALE FERN.

GEN. CHAR.—*Sori* elongate oblong or linear, all but the lowest on each pinna attached to the anterior side of the anterior venules, hidden amongst densely imbricated chaffy scales. *Indusium* obsolete. *Veins* forked or pinnate; venules anastomosing near the margin, the lowest posterior one soriferous on the side next the rachis.

This genus being without an indusium might seem to belong to the *Polypodiæ*, but the position of the receptacle on the *side* of the venules determines its affinity to be with the *Asplenieæ*.

The generic name is a modification of *Chetherak*, applied to this plant by the Arabian and Persian physicians.

1. **Ceterach officinarum**, Willdenow.—Common Scale Fern.—Fronds sinuate-pinnatifid; segments oblong-obtus, entire or lobed on the margin.

CETERACH OFFICINARUM, Willdenow; Bab. Man., 415: Florigr. Brit. iv., 81.: Newm. 293: Hook and Arn. Fl. 566.—GRAMMITIS CETERACH, Swartz: Franc 20.—SCOLOPENDRIUM CETERACH, Symons: Sm. Eng. Fl. iv., 315: Eng. Bot. t. 1244.—ASPENIUM CETERACH, Linnæus.—NOTOLEPEUM CETERACH, Newman, Brit. F. 9: App. v.—GYMNOGRAMMA CETERACH, Sprengel.

The Common Scale Fern has a tufted caudex producing branched penetrating roots. The fronds are terminal to the caudex, adherent, remaining green through the winter,



[*Ceterach officinarum*.]

the young ones appearing about May; they form a pretty tuft, the green of the upper surface well contrasting with the pale rust-coloured scales seen on the back of the half-unrolled fronds. The stipes is short, stout, dark-coloured at the base, and clothed with small brown narrow pointed scales. The fronds are from four to eight inches long, deeply pinnatifid; the divisions alternate, and sometimes divided quite down to the midrib, the pinnæ being separate and sessile. The entire under surface is clothed with a densely imbricated covering of small narrow pointed fimbriate

scales, at first whitish, changing to light brown; the points of some of these scales projecting beyond the margin of the

pinnae, give them a ciliated appearance. The venation is tolerably distinct in young fronds; but becomes more obscure as they get older or when dried. It is arranged thus:—at the posterior basal corner of each segment, a vein branches obliquely from the rachis, and extends in a sinuous course towards the apex, and nearer the lower than the upper margin; this produces alternate venules, the first of which, directed upwards, alone bears two sori, one on each of the two branches into which it separates, the lowest facing the rachis, the other turned from it; the other veins become branched near the base, the anterior venule bearing a sorus on the anterior side; consequently all the sori, except the lowest, are attached to the anterior side of the anterior venules. These branches, however, become again branched near the margin, and there anastomose in an irregular manner, the points being free, and extending almost to the margin. The sori are oblong, at first concealed by the scales, and at no time very apparent from the resemblance in colour between them and the scales on the mature fronds. The spore-cases are attached to the side of the veins, and immediately behind them, seated on the back of the vein, is a slightly elevated membranous ridge, which probably represents the indusium, and is no doubt the “erect white membranous involucre” which is mentioned by some writers.

This plant is found growing on old walls, ruins, churches, rocks, and similar situations, and is pretty generally distributed over England and Wales, abundant in Ireland, rather rare in Scotland, and apparently absent from the Northern and Western Isles. It occurs in the middle and south of Europe; in Madeira and the Azores, and in Brazil, according to Kunze.

It is a reputed diuretic, and was formerly used in medicine, but is now disregarded.

This is a free growing species under cultivation when once established. It dislikes close confinement, and re-

quires a very porous soil ; in fact, it should have a good proportion of old mortar, and broken freestone, in the compost in which it is planted. It may be grown either in pots, or planted out on rockwork ; and is not very particular as to the situation, but grows finest in the shade. It is propagated by division of plants.



[*Ceterach officinarum*.]

GENUS XII.

BLECHNUM, *Linnæus*.

HARD FERN.

GEN. CHAR.—*Sori* forming a continuous narrow line on the inner side of a series of transverse anastomosing venules near the mid-vein. *Indusium* continuous, bursting on the side towards the mid-vein. *Veins* forked free; mid-vein distinct; venules of fertile fronds united by a longitudinal or transverse anastomosing receptacle parallel to the midrib.

The name is latinised from *blechnon*, a Greek name for a fern.

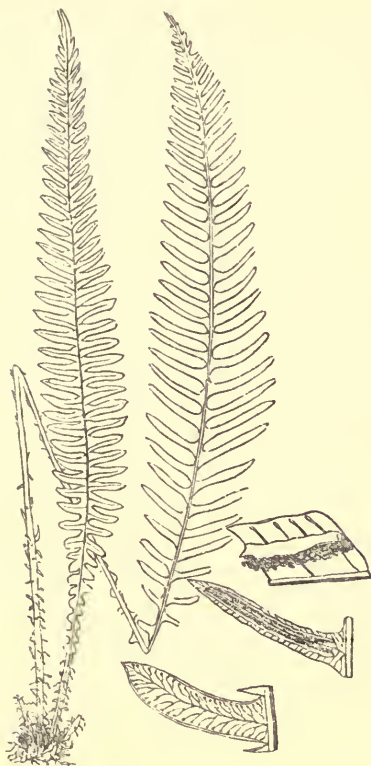
1. **Blechnum Spicant**, *Roth*.—Common Hard Fern.—Fronds dissimilar, linear-lanceolate; the fertile contracted erect, pinnate, with linear acute pinnæ of which the margins reflex; the barren ones prostrate pinatifid with broadly linear blunt flat lobes.

BLECHNUM SPICANT, *Roth*; *Withering*.—BLECHNUM BOREALE, *Swartz*: *Sm. Eng. Fl. iv.*, 303: *Eng. Bot.* 1159: *Hook and Arn. Fl.* 575: *Bab. Man.* 415: *Franc.* 53.—LOMARIA SPICANT, *Desvaux*: *Newm.* 89; *Florigr. Brit. iv.*, 51.—OSMUNDA SPICANT, *Linnæus*.—ASPLENium SPICANT, *Bernhardi*.—ACROSTICHUM SPICANT, *Sibthorp*.—ONOCLEA SPICANT, *Hoffman*.—OSMUNDA BOREALIS, *Salisbury*.—SPICANTA BOREALIS, *Presl*.

β. ramosum: apex of fronds constantly subdivided in a dichotomous way, and curled, *i.e.* multifid-crisped.

BLECHNUM SPICANT, *var.* RAMOSUM, J. R. Kinahan in litt. and Phytol. iv., 892.

The Hard Fern has a thick tufted scaly caudex, to which the fronds are terminal and adherent. The fronds perish in the winter, young ones springing up about May, and attaining maturity by the end of the summer. The barren ones are shorter than the fertile, narrow elongate-lanceolate tapering to both extremities, pectinate-pinnatifid, with close flat oblong obtuse segments somewhat curved in the direction of the apex of the frond, and having a prominent mid-vein with slender forked venules, the branches of which terminate just within the margin in a small, transparent, club-shaped head. These fronds usually lie in a nearly horizontal position, and are attached by a short, dark-coloured, slightly scaly stipes. The fertile fronds grow up from the centre of the tufts, and are usually quite erect; they vary from one to two feet in height, and are narrow elongate-lanceolate, pinnate. In ordinary cases the barren and fertile fronds are quite distinct, but sometimes both conditions occur on the same frond. I am indebted for specimens in illustration of this fact from Mr. G. F. Playne, collected at Nailsworth, in Gloucestershire, in one of which the base is barren, and the apex fertile, in another the apex is barren, and the basal parts fertile. The position of these fronds on the plants, was, I am informed, intermediate between the ordinary decumbent barren and the erect fertile fronds. The stipes is from a third to half the length of the frond, dark purple, smooth, with a few small scattered scales near the base, and the rachis is of the same colour. The pinnae are narrow linear acute, curved towards the apex of the frond, convolute at the margins, and covered on the under side with the confluent lines of spore-cases. Their venation is rather peculiar:—each pinna has a distinct mid-vein



[Blechnum Spicant.]

from which proceeds alternate veins; these extend about half-way to the margin, and then each turns at a right angle, proceeding along the pinna until it reaches the next vein, with which it unites, thus producing a longitudinal vein on each side the mid-vein and about equidistant between it and the margin. To the inner side of these longitudinal veins, which form the receptacles, the spore-cases are attached in a continuous series. They are covered by an indusium of the same linear continuous form which bursts on the inner margin, splitting up at intervals where the lateral veins have arisen. The fructification is mature in August and September.

There is a disposition in the fronds of this plant to become dichotomous, and in one variety for which I am indebted to Mr. J. R. Kinahan, and which I learn is constant, the apices of the fronds are subdivided in a di- or tri-chotomous way, the segments being blunt and curled, so that the frond assumes the multifid-crisped character found in some forms of *Scolopendrium*; this variety is called *ramosum*. It was found near Upper Lough Breagh, Wicklow, Ireland. Mr. Wilcke has sent me specimens from Blaydonburn and Tanfield Dean, Durham, in the former of which the segments are mostly bifid, and in the latter coarsely toothed, variations which occur also in the common Polypody, but I believe in this as in that case inconstant.

A common species occurring commonly in stony and heathy places, and showing itself to be fond of moisture. It is generally distributed throughout Europe, and occurs in the Canary Islands and at the Cape of Good Hope.

This plant is of easy culture, and extremely hardy, forming a splendid rock plant, and also luxuriating in swampy boggy places. It is, moreover, easily obtained, and propagates readily by division of its crowns.

GENUS XIII.

PTERIS, *Linnaeus*.

BRACKEN.

GEN. CHAR.—*Sori* linear continuous marginal, covered by the attenuated reflexed margin of the pinnules. *Veins* two or three times forked; *mid-vein* distinct; venules direct, their apices combined by a sporangiferous receptacle.

This plant is the *Filix fœmina*, or female fern of the old authors. It is unquestionably the most common and widely dispersed of our indigenous ferns, often entirely over-running extensive tracts of country, but apparently not occurring on the chalk.

The name is the Greek *ptēris* signifying a fern, and that comes from *pteron* a wing or feather, and is applied in allusion to the form assumed by the fronds.

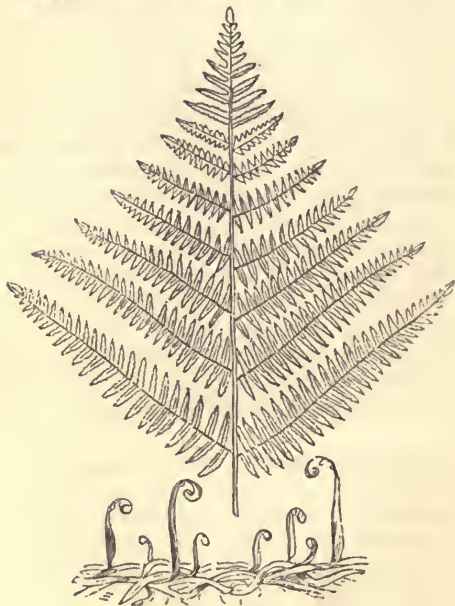
1. ***Pteris aquilina*, *Linnaeus*.**—Common Brakes or Bracken.—Fronds bi-tri-pinnate; primary pinnæ in pairs; ultimate divisions sessile, the terminal one elongate. There appear to be two very distinct forms of this plant:—

a. vera; pinnules for the most part pinnatifid, or sinuate, the segments oblong-obtuse.

PTERIS AQUILINA, *Linnaeus*: Sm. Eng. Fl. iv., 305: Eng. Bot. 1679: Bab. Man. 415: Newm. 93: Florigr. Brit. iv., 54: Hook and Arn, Fl. 575: Franc. 55.—EUPTERIS AQUILINA, Newman, Phytol. ii. 278; App. iii.

β. integerrima ; pinnules almost all entire, one or two basal ones sometimes very slightly lobed.

PTERIS AQUILINA, var. *INTEGERRIMA*, Moore in ed. 1.



[*Pteris aquilina*.]

The Common Bracken has an extensively creeping subterraneous, thick, succulent, dark brown caudex, some-

what velvety externally, often forming thickly interwoven usually horizontal masses just beneath the surface of the soil. The fronds, which are lateral and adherent, and produced singly at intervals along the caudex, are of annual duration; the young ones grow up in May, and being extremely succulent and tender, are often killed by late frosts; they become mature by the latter end of July, and are invariably killed early by the autumnal frosts, then becoming of a reddish brown colour, but from their rigid texture, maintaining for some time their form and position. When they first grow up the tops are bent down against the stipes, from which position they rise and expand gradually. They are very variable in size, from six to eighteen inches on poor soil, and parched situations, to three or even eight and ten feet in rich soil and sheltered localities. Their form also varies—the smaller states being usually somewhat triangular, and the larger much more elongated. The stipes is rather over half the length of the frond, and is green, somewhat pubescent when young, and when mature angular with sharp edges which inflict severe wounds if the plants are incautiously pulled; the part under ground is black, velvety, and spindle-shaped. A transverse section of the stipes presents the ends of the vascular bundles arranged in a figure which is by some thought to resemble the imperial eagle, whence the specific name.



The composition of vigorous fronds is thrice pinnate. Sometimes, when grown in exposed situations, the first pair of pinnae are unusually enlarged, giving to the frond a kind of tripartite-appearance; but under other conditions, the primary rachis becomes extended, throwing

out at intervals the almost opposite bipinnate pinnæ, several pairs being in many cases produced. The form of the primary pinnæ is usually ovate, that of the secondary pinnæ narrow-lanceolate, the former being nearly opposite in distant pairs, and the latter near together, either opposite or alternate along the secondary rachis. The pinnules are attached by their base without a footstalk either alternately or opposite along the tertiary rachis, becoming confluent towards the apex, the terminal often considerably larger and more elongate than the rest. Their form is oblong-lanceolate, deeply pinnatifid, or sometimes only sinuate, the lobes being oblong-obtuse. The venation is arranged thus:—the mid-vein produces a series of veins,



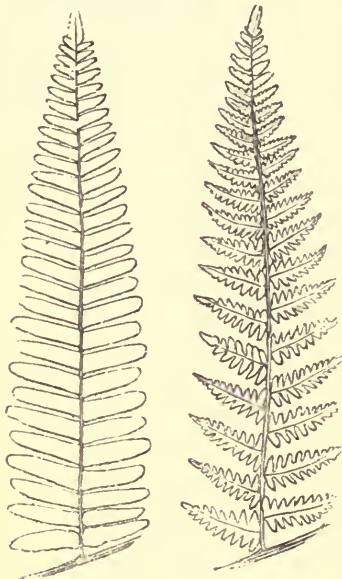
which become mid-veins to the lobes, and these branch into a further series of venules, which are either once or twice forked, and extend to the margin; the lowest branch right and left of the mid-veins of the lobes usually meet and unite, forming a rather irregular longitudinal vein parallel with the mid-vein of the pinnule; and along the edge of the pinnules,

and also of the lobes and interstices, extends a marginal vein, to which the ends of the other veins are united. This marginal vein bears the fructification, the spore-cases being arranged on it in a continuous line, and covered by a bleached membranous reflexed extension of the epidermis of the upper surface of the frond, which serves as an indusium; the epidermis of the under surface being also developed in a similar way, and forming a membrane on which the spore-cases lie; both membranes being fringed at the margin with jointed hairs. The fructification is

mature in July and August. The plant has, especially when young, a strong peculiar odour. Weak plants are only bipinnate.

The variety *integerrima* differs only in the form of

its pinnules, which are not pinnatifid or sinuated, but quite entire or with only one or two of the basal ones very slightly lobed. The pinnules are hence obtusely oblong; and each pinnule develops a distinct mid-vein, which on either side produces a series of veins that are once or twice forked. This form has a very different aspect from the pinnatifid form, and appears to be constant. It is, at least,



β [Pteris aquilina α and β.] α

not caused by difference of situation, as both occur indiscriminately intermixed.

This, as already remarked, is the most common of our indigenous ferns, and is found abundantly on every description of soil, except chalk, which it appears to shun, as it does the habitation of man, taking refuge (as Newman observes) in wastes and wildernesses. It is extensively distributed throughout Europe, and is found in Asia, Africa, and North America. When growing in exposed situations, it assumes a rigid and uncouth aspect; but when in its most luxuriant state, it is a plant of surpassing beauty. Certainly I have nowhere seen, among our native species, such a scenic effect as was produced by this species, growing eight or ten feet in height, in a hedge-row bank, skirting a damp shady lane, its expansive fronds gracefully arching out from among the brushwood which concealed and supported their base. For any such damp half-shady positions in artificial wilderness scenery, this species, common though it be, deserves to be recommended.

The Bracken is applied to various uses. The underground succulent stems abound in starch, and, as stated by Lightfoot, have been used in different countries as an ingredient in making a miserable kind of bread. They have also been employed in brewing ale, being used in the proportion of one-third to two-thirds malt. Mr. Forsyth obtained a substance like coarse brown flour, by grating the clean-washed stems, washing the pulp, and straining it through a fine wire sieve; and by first scraping off the brown outer coating, white fecula was obtained, which, when boiled, was without any disagreeable taste. The fecula, he says, may be easily converted into malt, and, mixed with a very small quantity of real malt, will produce good beer. Both the under-ground stems in winter, and the tender shoots in spring, are, when boiled, a nutritious food for pigs, but not proper for young ones. The young succulent fronds also make an excellent green manure, if cut and dug or ploughed in immediately. The dried fronds make a very durable thatch, for which pur-

pose they should be pulled up in October, when perfectly pliant; they are, besides, valuable as litter, and even sometimes mixed with hay as fodder for cattle; and they form one of the best of all protecting materials in gardens, and are much used for packing purposes. The plant abounds in alkali, which is turned to account in the manufacture of soap and glass. The ashes of the full-grown plant may be used in the wash-house, to economise soap; they are mixed with enough water to allow of their being made up into balls, then dried, and, when required for use, are put into a fire until they acquire a red heat, when they are taken out and thrown into water, which, in an hour or so, becomes a strong ley. The plant is so astringent that it has been employed for the purpose of tanning kid and chamois leather. Medicinally, the Bracken is said to have had, among the ancients, a reputation in chronic disorders, especially those arising from obstructions of the viscera and spleen, but it is not now esteemed, though sometimes used, in the form of powder, to destroy worms, especially the tape worm; the caudex is the part used, in doses of from one to three drachms, repeated for several mornings, and followed by a brisk purgative.

No plant can require a less amount of cultivation when it is established, but there is a real or imaginary difficulty about transplanting it; and it is even said, on high authority, to be killed by transplantation. There is, however, no difficulty in transplanting it, if the caudex is removed during winter, while dormant; on the contrary, it is sometimes found troublesome in soils collected at that season for potting purposes. It will grow freely in any temperature; and though occurring in exposed situations, it is very much finer in damp shady places.

GENUS XIV.

ADIANTUM, Linnæus.

MAIDENHAIR FERN.

GEN. CHAR.—*Sori* transverse marginal, oblong or subglobose. *Indusium* venose, formed of the membranous reflexed apices of the lobes of the frond, and bearing the spore-cases on its under surface. *Veins* forked radiating; *venules* direct terminating in the axis of the indusium.

The name is derived from the Greek *adiantos*, dry, unmoistened; the plant possessing the property of repelling water.

1. **Adiantum Capillus-Veneris, Linnæus.**—Common Maidenhair.—Fronds bi-tri-pinnate; pinnules unequally wedge-shaped, alternate, with capillary stalks, lobed, the lobes of the fertile pinnules reflexed, bearing the transversely oblong submarginal sori, and prolonged into membranous indusia.

ADIANTUM CAPILLUS-VENERIS, Linnæus: Sm. Eng. Fl. iv., 307: Eng. Bot. 1564: Hook and Arn. Fl. 576: Bab. Man. 416: Florigr. Brit. iv., 49: Newm. 83: Franc. 59.—ADIANTUM CAPILLUS, Link.

The Common Maidenhair Fern has a black scaly slowly-creeping caudex, with dark-coloured wiry roots. The fronds, which are very delicate and graceful, appear

in May, and retain their freshness through the winter, if duly sheltered; they are more or less drooping, and are lateral and adherent to the caudex. The stipes is slender, dark purplish-black shining, with a few narrow pointed



[*Adiantum Capillus-Veneris*.]

are the little stalks by which the pinnules are attached; and when after the period of maturity the pinnules fall off, these capillary divisions of the rachis remain persistent

scales attached to its extreme base, and from a half to two-thirds of its lower extremity destitute of pinnæ. The fronds are of irregular outline, sometimes approaching a triangular form, sometimes nearly ovate, or elongate-lanceolate, varying from six to twelve inches in length, twice-pinnate. The pinnæ and pinnules are both alternate. The shape of the pinnules is variable, but few having the same form; they are, however, usually irregularly fan-shaped, with a wedge-shaped base, the fertile ones being more or less deeply cut on the margin, and the barren ones sharply serrated. The rachis both of the fronds and of the pinnæ is slender and hair-like,

but most especially so

like short stiff bristles. The texture of the frond is thin and delicate, and the colour a cheerful green. The venation is peculiar, and consists of a series of dichotomous ramifications of the rachis, the first ramification forming the extreme base of the pinnule, and the branches becoming again and again forked, so as to occupy the pinnule with a series of contiguous radiating venules. In the sterile portion of the fronds one of the venules is directed to each marginal serrature, in which it terminates, but in the fertile parts they each terminate in the axis of the lobes, where they become united with the sporangiferous receptacle which is continued across the indusium. The sori are small roundish, soon becoming confluent into an interrupted linear series, lying crosswise near the apices of the reflexed bleached portion of the lobes, which serves as an indusium. The fructification becomes mature about July.

This most delicate and graceful Fern is very local, being found in moist caves and attached to moist rocks, chiefly in the vicinity of the sea, preferring, it would seem, a perpendicular surface. It occurs principally in Cornwall and Devon, in South Wales, and in Ireland; and has otherwise a wide geographical range, comprehending the warmer parts of Europe, Asia, northern Africa, the Canary and de Verd Islands, and North America.

It is reported to possess expectorant and diuretic virtues, and to be the plant from which the syrup called *Capillaire* is prepared; *Adiantum pedatum* and *Asplenium Trichomanes* being also said to furnish it. The people of the south isles of Arran use a decoction of the leaves in place of tea.

This fern does not bear exposure, but flourishes in a confined damp atmosphere, attaining its greatest luxuriance when supplied with a moderate degree of warmth. It is essentially a shade-loving plant, and is peculiarly fitted for a Wardian case.

GENUS XV.

TRICHOMANES, *Linnaeus*.

BRISTLE FERN.

GEN. CHAR.—*Sori* marginal vertically oblong; *spore-cases* compressed, sessile around columnar filiform receptacles (which are extramarginal extensions of the veins) within elongated urn-shaped involucres of the same pellucid texture as the frond; *receptacle* more or less exserted. *Veins* direct free, simple or forked.

Our native *Trichomanes* is the only European species of an extensive and extremely beautiful group of ferns which is very abundant in the tropics.

The name is an ancient Greek word supposed to have been applied to the fern called *Asplenium Trichomanes* by *Linnaeus*.

1. ***Trichomanes radicans*, Swartz.**—European Bristle Fern.—Fronds tri-quadri-pinnatifid pendulous, triangular ovate or elongate, glabrous; segments linear, entire, or obtusely bifid; involucres cylindrical scarcely two-lipped, solitary in the axils of the upper segments, more or less winged.

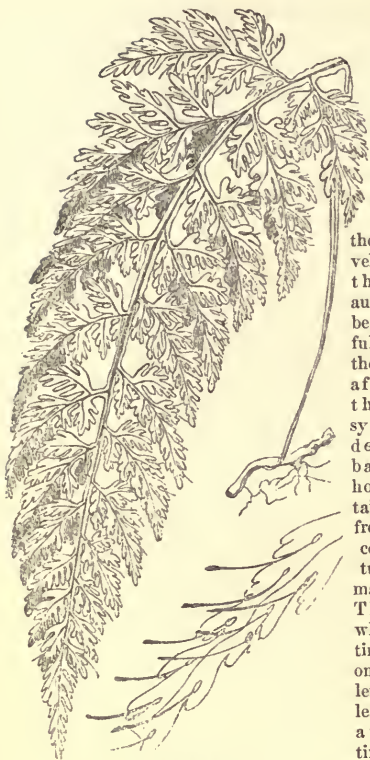
TRICHOMANES RADICANS, Swartz: Hook. Sp. Fil. i, 125: Bab. Man. 415: Hook and Arn Fl. 576: Florigr. Brit. iv, 119.—TRICHOMANES SPECIOSUM. Willdenow: Newm. 305.—TRICHOMANES BLEVISETUM, R. Brown: Sm. Eng. Fl. iv., 311: Franc. 62.—TRICHOMANES ANDREWSII, Newm. Ferns, 14.—TRICHOMANES EUROPEUM, Smith.—TRICHOMANES ALATUM Hooker Fl. Lond. t. 53.—TRICHOMANES PYLIDIFERUM, Hudson.—HYMENOPHYLLUM ALATUM, Smith, Eng. Bot. 1417.—DILYMOGLOSSUM ALATUM, Desvaux.

The Bristle Fern, one of the most rare and delicate of all our native species, has an elongated creeping dark coloured rooting caudex, clothed with small thick-set narrow articulated scales, or bristles. The fronds, which are circinate in veneration, and from six inches to a foot long, consist of hard wiry branched ribs, or veins, each



[*Trichomanes radicans*.]

furnished throughout with a semi-membranous, pellucid wing, becoming more or less consolidated, varying in outline from angular ovate approaching triangular, to oblong-acuminate, or lanceolate, the latter being the form of what has been considered a variety and called *Andrewsii*. They are lateral and adherent to the caudex from which they spring up solitary here and there, as it extends over

[*Trichomanes radicans*.]

the damp surface of the rocks. It is stated that they are three years arriving at a mature condition, attaining their full development in the second autumn, and becoming fruitful in that of the third year, after which they show symptoms of decay; the barren fronds, however, retaining their freshness in congenial situations for many years. The stipes, which is sometimes less than one-fourth the length of the leafy portion, and sometimes equals it in length, is

winged or bordered almost to the base. The fronds are usually thrice pinnatifid, the ovate lanceolate, alternate, primary divisions becoming almost pinnæ; the secondary lobes are broadly or narrowly ovate according to their position, and the ultimate divisions are narrow linear, pellucid, entire or obtusely biid. The whole of the leafy part is of a cellular texture. The veins consist of wiry ribs, branching and extending through all the divisions of the frond; in the barren parts terminating at or within the apex of the ultimate lobes, but where the fructification is produced becoming extended beyond the margin, the free portion surrounded at the base, where they are encircled by the spore-cases, by a monophyllous elongate cup-shaped involucre, beyond which the apex is more or less lengthened. The base of the free portion of the veins is hence the receptacle. The involucre either projects beyond the margin or is, at it were, immersed in the substance of the frond as in *Andrewsii*, and there are various intermediate conditions. The degree in which the receptacles are elongated is very variable, sometimes they project but slightly, sometimes they are two or three times or five or six times as long as the involucres, and curve up from the surface of the fronds in a very conspicuous manner. The fructification becomes mature in the autumn.

This species is not certainly known to exist in a wild state in the United Kingdom elsewhere than in Ireland, where it is found sparingly in several localities attached to dripping rocks, and the walls of damp caves, in shaded glens, and in the vicinity of waterfalls. It is also found in some of the warmer parts of Europe, in Asia, and in South America.

This Fern requires a damp calm atmosphere, without which it will not thrive; hence, all attempts to cultivate it artificially, other than under close confinement, have failed. It likes warmth, and succeeds admirably under a glass in a shady part of a plant stove, or greenhouse. The following method of planting is suitable both to this and to the *Hypnophyllum* :—

Procure some porous free-stone (if in one mass, so much

the better) large enough to fit the mouth of the pot or pan, which should be a good sized one, as the plants should be seldom disturbed; and after filling the latter so full of broken crocks for drainage, as to admit of the sandstone lying firmly on a level with, or rather above the rim, strew a little silver sand over the stone, and with incorrosive wire, fix the caudex of the plant firmly on the surface, then a little more sand, followed by a good watering. If necessary, the plant must be supported in a firm position by means of some small stakes, judiciously placed, with great care, for neither the plant nor the sand should be disturbed when it is once fixed. After planting, place a bell glass over the plant, and remove it to a shady place, either in a stove or greenhouse, or sitting room. After this, all that is required is careful and rather abundant watering, sufficient at least to maintain a constant dampness about the plant. Mr. Andrews, of Dublin, in September 1841, formed a case purposely for cultivating this fern; he lined the bottom with zinc, and covered the framework with oiled lawn, and then planted the specimens in well drained pots in a compost of loam and coarse sand, interspersed with pieces of turf. He also suspended the stems across the roof of the case, attached to rods, covered with moss. The plants were kept cool, and were well moistened daily. In October, 1843, the entire case was filled with fronds of large and strong growth. Mr. Ward has for many years cultivated this species with entire success, even amidst the smoke of London, in his close cases: and fine examples of cultivated *Trichomanes* are now not rare. The most entire success, however, of which any record has been made public, is that obtained by R. Calwell, Esq., of Dublin, as stated in Mr. Ward's excellent book already quoted, from which the following is also borrowed. Mr. Calwell writes:—

“ In the spring of 1843, I received a small portion of rhizome, about five or six inches long, with one frond partially developed, and one other just appearing, which I placed in a bell-glass about fifteen inches diameter. In December 1846,

it quite filled the glass, and in that month I removed it into a case 3 feet 10 inches by 2 feet 6 inches, and 3 feet 4 inches in height—the space under this, about twelve inches in depth, was filled with upturned flower-pots, charcoal, cocoa-nut husks, and light earth and peat. The plant now nearly fills this case. It is difficult to count the fronds accurately, but, as nearly as I can count them, they number two hundred and thirty or upwards, of fully-developed fronds; the length of the fully-opened fronds being from fourteen to twenty and a-half inches taking the length from the end of the stem, where it starts from the rhizome, to the point of the frond. When removing it to the present case, in December 1846, I cut away five or six fronds which had been injured by contact with the glass, but since that time not one of the fronds then existing, nor any of those since formed, have shown any symptoms of decay. As to the general treatment: having originally provided well for perfect drainage, I carefully sprinkle the surface of the fronds with water once or twice a week in summer, and less frequently in winter, and keep the door of the case (which is very close) always shut, the drainage-valve underneath always open. The case stands in a vestibule with nearly west aspect, quite sheltered from the south by the house, which is much higher than the vestibule. I strongly think that much of my success is due to the fact that the light is much subdued by shining through coloured glass windows (chiefly brown and orange). The general appearance of the plant is quite natural, the fronds bending down mostly. About three years ago, I placed, for experiment, a small portion of the rhizome with one open frond, on a block, and hung it up in the case. It has now nineteen expanded fronds, varying from nine to twelve inches in length, the rhizome having crept all round the block, and throwing down abundance of roots five or six inches long. I have not found any other fern to thrive or even to live, in this case, except *Asplenium marinum*, which seems to like the situation tolerably. I have even tried *Hymenophyllum tunbridgense* and *H. Wilsoni*; neither of which lived past one

year. The plant has never shown the least approach towards producing seeds, although I have seen many plants taken from the same locality (Turk's Waterfall, Co. Kerry) which have fructified profusely."

This instance of success (Mr. Ward goes on to state) is suggestive of one or two reflections of practical application. "We see, first, how possible it is to grow some plants in closed cases in even more than their native luxuriance. I believe it would be very difficult, if not impossible, to find such a patch of *Trichomanes* as is above described, either in Ireland or in any part of the world. The next reflection is, that, in obedience to well-known physiological laws, whenever the foliage of a plant is developed to a greater extent than usual, the tendency to produce fruit becomes proportionally diminished, and sometimes, as in the above instance, ceases altogether—not one frond out of the two hundred and thirty fructifying. It would be interesting to watch the effect of exposure to stronger light, and of a diminished supply of water. We further learn that ferns, like other plants, vary much as to their natural states, and that, in order to grow even the British ferns in one case, it will be necessary to pay attention to their respective wants.

"In order to grow all our ferns under one roof, it would, of course, be necessary to fulfil their varying conditions of growth; and this might be easily effected by building a model of some antique ruin, or by imitating some mountainous ravine, or other bit of natural scenery, with water trickling down from the elevated portion of the rock, and flowing out of the house in a continuous stream at the bottom. In such a house, without any artificial heat, our ferns would attain a luxuriant growth, unimaginable by those who know them only under ordinary circumstances. Each fern could be supplied with a proper base of earth or rock, and each could have the amount of light most suited to its fullest development. The *Trichomanes* might there revel on its Turk rock, and gladden the eyes of the beholder with its lovely fronds spangled with

iridescent rain-drops. At the base of the rock and extending to the margins of the central brook, the two species of *Hymenophyllum*, with *Blechnum boreale*, *Lastrea Thelypteris*, and the lovely Lady Fern would luxuriate; whilst on the borders of the little brook or in the centre of the water, the royal *Osmunda* would raise itself to the height of ten or twelve feet, as if conscious of its sovereignty, and worthy of the admiration elicited from Sir Walter Scott when visiting the Lakes of Killarney. One or two chalk or sand-stone caves might be lined internally with the *Asplenium marinum*, its massive dark green and glossy leaves beautifully contrasting with the light and elegant foliage of the Maidenhair growing on the top. In the more elevated portions, and fully exposed to light, *Allosorus crispus*, *Cystopteris fragilis* and the other species and varieties would thrive (with the exception of the rare *Cystopteris montana* which should be planted in reach of the spray); as would *Asplenium septentrionale* and the *Woodsias*; whilst every clink and crevice might be occupied with *Polypodium Dryopteris*, *P. calcareum*, *P. Phegopteris*, *Asplenium Trichomanes*, *A. Adiantum-nigrum*, *A. lanceolatum*, &c. Such a house might be made very useful in determining those varieties of ferns which depend upon varying climatal differences, and in limiting the multiplication of species, which now appears to be increasing rather too rapidly. A great number of the more beautiful or rare British flowering plants might be intermixed with the ferns, and would add greatly to the effect of the whole, taking especial care that each should have the amount of light and moisture which it obtains in its natural state. So much for British ferns and plants; but the time will most assuredly come when those citizens of London who now recreate and refresh their souls with such a house as is above described, will raise their desires to the possession of equally beautiful, but much more noble and majestic forms; I mean, particularly, those of the 'Tree ferns.'

GENUS XVI.

HYMENOPHYLLUM, *Smith.*

FILM FERN.

GEN. CHAR.—*Sori* marginal vertically oblong; *spore-cases* sessile around a columnar subclavate receptacle within an urceolate two-valved involucre of the same pellucid texture as the frond; *receptacle* included. Veins direct, free, simple or forked.

Film-fern seems preferable to Filmy-fern as the English name of this group, which includes a large number of tropical species, mostly small and many of them very beautiful.

The name of the genus is derived from the Greek *hymen* a film or membrane, and *phyllon* a leaf; and is admirably characteristic of the membranous texture of the fronds.

1. **Hymenophyllum tunbridgense, *Smith.***—Tunbridge Film Fern.—Fronds membranous pinnate; pinnae distichous vertical pinnatifid, the segments linear undivided or bifid, and as well as the axillary solitary compressed involucre, spinulose-serrate; rachis winged.

HYMENOPHYLLUM TUNBRIDGENSE, *Smith, Eng., Fl. iv., 326*: *Eng. Bot. 162*: *Hook. Sp. Fil. i, 95*: *Hook and Arn. Fl. 577*: *Bab. Man. 416*: *Newm. 321*: *Franc. 60*: *Florigr. Brit. iv., 122*.—TRICHOMANES TUNBRIDGENSE, *Linnaeus*.

The Tunbridge Film Fern is a slender delicate species, having a black thread-like creeping caudex, which is often matted and entangled, forming, along with the moss which accompanies it, a thick close turf over rocks and stones, and is furnished with a few scattered hair-like scales. The fronds are lateral, adherent, small, and of tender membranous texture, from one to four inches high, somewhat lanceolate ovate, pinnate, the pinnae distichous vertical alternate, once or twice pinnatifid, and connected by a wing extending along the rachis, the pinnae, wings, and involucres all lying in the same plane. The pinnae, moreover, though sometimes branched alternately, have a decided tendency to ramify on the anterior rather than the posterior side. The ultimate segments are linear obtuse, with a prominent central vein, and a spinulosely serrate margin. The fronds may be considered as a series of stiff branched veins, furnished with a membranous wing throughout, except in the



[*Hymenophyllum*
tunbridgense.]

lower part of the stipes, which latter varies from one third to one half of, or equal to, the length of the fronds. The sori are usually borne by the first vein on the anterior side of the pinnae, thus becoming supra-axillary. Deviations from this may be sometimes observed, in which, from the involucres and their contents having taken the place of the lobes of the leafy part of the frond, the identity of origin between them becomes manifest; in fact, in ordinary cases, the fructification takes the place on the fertile pinnae, of the first superior lobe of the barren pinnae. The spore-cases are collected into a roundish mass upon the receptacle, which is formed of a

vein lengthened out beyond the margin, and assuming a cylindrical or sub-clavate form; and they are surrounded by an involucre of two nearly orbicular valves, spinulosely serrate on the upper margin, and adpressed throughout the greater part of their length, but become slightly gibbous at the base, where the spore-cases are situate. The receptacle does not extend much beyond the middle of the valves. The plant is of an olive green colour, and is seen to be elegantly reticulated when slightly magnified.

This little moss-like species is found widely distributed in England, Wales, Scotland, and Ireland, growing amongst moss in mountainous situations, or on the surface of damp rocks and stones. It is also found in the alpine districts of Europe, in the Azores, Madeira, and the Mauritius, at the Cape of Good Hope, in South America, Tasmania, and New Zealand.

2. *Hymenophyllum unilaterale*, Willdenow.—

Wilson's Film Fern.—Fronds rigid pinnate; pinnæ subsecund recurved, four to six lobed, the segments linear undivided or bifid spinulose-serrate; involucres solitary axillary ovate inflated entire; rachis slightly margined.

HYMENOPHYLLUM UNILATERALE, Willdenow: Newm. 14.—HYMENOPHYLLUM WILSONI, Hooker, Brit. Fl. 446: Eng. Bot. Supp. 2686: Newm. 325: Hook and Arn. Fl. 577: Bab. Man. 416: Florigr. Brit. iv., 124.

Wilson's Film Fern resembles the Tunbridge species in its general features; the texture of the frond in both is delicately membranous and pellucid, and when magnified even but slightly, is seen to be composed of closely arranged cells, which give it a beautifully reticulated appearance, only in this the reticulations are somewhat larger. The caudex is filiform, creeping, and sparingly furnished with small brown pointed scales. The fronds are lateral, adherent, linear lanceolate, rigid, pinnate, from one to four inches high, or sometimes larger. The stipes is of variable length, as in the allied species, terete,

the rachis being also terete in the lower part, and slightly winged above. The pinnæ are convex above, or recurved so as to appear sub-unilateral, the involucre being usually curved in an opposite direction; they are wedge-



shaped in outline, digitate-pinnatifid, the segments being linear obtuse, and spinulosely serrate along the margins. The fructification is in this species also axillary; but the receptacle is surrounded by an involucre of two oblong convex or inflated valves, touching only by their edges, which are quite entire. In its texture and colour the plant is very similar to the *Hymenophyllum tunbridgense*; in both, the young fronds are produced towards the end of the summer, and retain their green colour until the next year, after which they become brown, and finally almost black.

This species is like its congener widely distributed throughout the United Kingdom, growing on the mountains and on damp rocks; the present is, however, the more abundant of the two in the Highlands of Scotland and in Ireland. It is found in other parts of Europe, at the Cape of Good Hope, in New Holland, and South America.

The *Hymenophyllums* may be cultivated in the same manner as the *Trichomanes*. The surface on which the plants are placed should be covered with a thin layer of sand and finely-cut sphagnum moss.

GENUS XVII.

OSMUNDA, *Linnaeus*.

ROYAL FERN.

GEN. CHAR.—*Fructification* naked, densely clustered on contracted rachiform portions of the frond, forming an irregular terminal panicle. *Spore-cases* large reticulated subglobose, stalked, two-valved, opening vertically. *Veins* forked; *venules* direct, free.

The name is of uncertain derivation. There is a legend that it commemorates Osmund a waterman of Loch Tyne, whose wife and fair-haired daughter were hidden among *Osmundas* during an incursion of the Danes. *Osmund* is a Saxon word for domestic peace, from *os* house, and *mund* peace.

1. ***Osmunda regalis*, *Linnaeus*.**—Royal Fern, Flowering Fern, or Osmund Royal.—Fronds bipinnate; pinnules oblong nearly entire, dilated and somewhat auricled at the base; spore-cases arranged in a clustered terminal panicle.

OSMUNDA REGALIS, *Linnaeus*: Sm. Eng. Fl. iv., 314: Eng. Bot. 209: Hook and Arn. Fl. 578: Bab. Man. 417: Florigr. Brit. iv., 36: Newm. 332: Franc. 63.

The Royal Fern is the most stately of the British species. Its tufted caudex—which attains a large size, and in damp shady situations, a height of two feet and

[*Osmunda regalis*.]

upwards,—acquiring a resemblance to the trunks of the tree ferns—is very firm, and beset with numerous strong fibres. The fronds are circinate in veneration, and when quite young are very tender, shooting up with rapidity, and attaining sometimes the height of ten or twelve feet in damp sheltered spots, and from two to four feet in more exposed and drier situations; they are developed in May, and destroyed by the early frosts. The stipes is stout, smooth, without scales, variable in length, and as well as the rachis succulent and tinged with red while young, but becoming woody. Some fronds are entirely barren, others bear fructification, the latter differing from the former only in the presence of the panicle of spore-cases.

The fronds are lanceolate, bipinnate, with the nearly opposite pinnae arranged in pairs; they are erect, or less frequently and chiefly when growing by water, somewhat pendulous. The pinnae are lanceolate or ovate-lanceolate, with opposite or alternate pinnules; the latter of an oblong or oblong-ovate form, blunt at the apex, somewhat dilated and auricled at the base, especially on the posterior side, and often serrated; the apical pinnule being usually somewhat more acute than the rest. The venation is very distinct: each pinnule has a prominent midvein, the veins from which are forked almost at their base, the venules being usually again divided, running in parallel lines, and terminating in the margin. The fructification consists of the upper pinnae changed from the leafy to a soriferous state, and forming a more or less compact panicle of spikes, covered over with spore-cases, attached to the veins of the altered pinnules, of which only a slight wing is developed on each side the midvein. Not unfrequently the pinnules on some of the pinnae are but partially transformed, a few masses of sori occurring at the base, while the apex remains leafy. Sometimes the pinnae near the apex become soriferous, while the extreme apex itself remains leafy and barren. These modifications indicate the true nature and origin of the fructification. The spore-

cases are subglobose, reticulated, supported by a short stalk, and somewhat two-valved, opening vertically, the valves being supposed to originate in the upper and lower epidermis of the frond. The fronds are terminal and adherent to the caudex.

This plant is generally distributed through the United Kingdom, but chiefly confined to marshy places, and not very abundant. In Ireland it is plentiful; and it is found throughout Europe, in Asia and Africa, and a very closely allied form in North America.

The caudex is said to possess tonic and styptic properties, but has fallen into disuse.

This species is of easy cultivation, preferring moist situations, and a peaty soil. It is very suitable to plant about rockwork, in places where its habits can be accommodated—that is, when abutting a piece of water; and though most luxuriant in a sheltered position, does not refuse to grow when moderately exposed. It is propagated by detaching and planting any lateral offshoots from the caudex. The best way to establish it is to procure the most vigorous plants from the localities where it is spontaneous.

GENUS XVIII.

BOTRYCHIUM, Swartz.

MOONWORT.

GEN. CHAR.—*Fructification* naked, clustered on a contracted branch of the frond, constituting a compound sporangiferous unilateral panicle. *Spore-cases* large, sessile, globose, without reticulations, two-valved opening transversely. *Fronde* two-branched. *Veins* simple or forked, radiating; *venules* direct free.

The name is derived from the Greek, *botrys* a bunch of grapes; the spore-cases being produced in branched clusters.

1. **Botrychium Lunaria, Swartz.** — Common Moonwort.—Fronde solitary; barren branch pinnate; pinnæ lunate or fan-shaped, jagged or crenate.

BOTRYCHIUM LUNARIA, Swartz: Sm. Eng. Fl. iv. 315: Hook and Arn. Fl. 578: Bab. Man. 417: Newm. 337: Florigr. Brit. iv. 24: Franc. 65.—OSMUNDA LUNARIA, Linnæus: Eng. Bot. t. 318.

The Common Moonwort is almost without a caudex, this part being reduced to a mere point at the base of the stipes, furnished with stout succulent brittle roots, issuing in irregular whorls from a thicker perpendicular one. The fronds are annual, growing up towards the end of April, and perishing in the course of the summer or the autumn; the entire plant growing from three to ten inches high.

When at rest, the plant consists of a bud or hybernaculum, in which the incipient fronds are encased by brown membranous sheaths, the persistent bases of the fronds of former years. Enclosed in these sheaths the entire fronds are found in an embryo condition, but perfectly formed, with their two branches placed face to face, the fertile one clasped by the barren. Within the base of the growing frond of one year, are thus enclosed the rudimentary buds of the two following years. The stipes is erect, smooth, cylindrical, and hollow, with two or three bundles of woody fibre embedded in its succulent substance; at the base it is invested by the sheaths already alluded to; above, it becomes divided into two branches or pinnæ, of which one is leafy and barren, the other fertile, both pinnate. The pinnules of the leafy branch are smooth, glaucous green, lunate or flabelliform, the margins crenate, or more or less deeply lobed; sometimes they become partially fertile, and they are occasionally pinnatifid, or linear and acute. The fertile portion is divided into branches corresponding to the pinnules.

[*Botrychium Lunaria*.]

which are again more or less branched ; and on the secondary branches are produced, distinct but clustered, the brown globose stalkless spore-cases formed of two concave valves, which when mature open transversely. Occasionally it happens that two or more fertile branches are produced. The fronds are folded straight in veneration. The veins are free, proceeding from the base of the pinules, irregularly forked and radiating towards the margin. The fructification is mature early in June.

This is a local plant, though widely distributed in the United Kingdom, occurring in dry open heaths, and elevated pastures. It is also found throughout Europe, in Asia, and North America.

This is a difficult plant to get established under cultivation, often refusing to vegetate. This probably arises from its being placed along with other ferns, and kept too damp, and for the most part too closely confined. It rather prefers to be kept moderately dry, cool at the root, and where there is a circulation of pure air. It prefers rich vegetable soil ; unctuous peat earth is very suitable for it, but it requires to be well drained. The roots should be transplanted in the spring when dormant.

GENUS XIX.

OPHIOGLOSSUM, *Linnæus*.

ADDER'S TONGUE.

GEN. CHAR.—*Fructification* naked arranged in two lines along the margin of a contracted frond forming a compact flattened simple spike. *Spore-cases* sessile connate, leathery, without reticulations, two-valved opening transversely. *Fronde*s two-branched. *Veins* uniform, reticulated, forming elongated meshes.

The name is derived from *ophios* a serpent, and *glossa* a tongue; the fertile branch of the fronds having some resemblance to an adder's tongue.

1. **Ophioglossum vulgatum**, *Linnæus*—Common Adder's Tongue.—Fronde solitary; barren branch ovate-obtuse.

OPHIOGLOSSUM VULGATUM, *Linnæus*: Sm. Eng. Fl. iv., 316.—Eng. Bot. 108: Bab. Man. 417: Hook. and Arn. Fl. 578: Florigr. Brit. iv., 33: Newm. 349: Franc. 66.

The Common Adder's tongue has the habit of the Moonwort, but a different structure. Like it, too, it is folded straight in veneration, in which respect these two plants differ from all other British ferns. The caudex is represented by a central crown, which produces a few coarse brittle fleshy roots, some of which extend horizontally

beneath the surface, and produce a new plant at a short distance from the old. The old crowns produce a new frond annually, as is the case with *Botrychium*, but in this the rudimentary plant is exterior to the stipes, instead of being enclosed within its base, as is the case in *Botrychium*. The fronds are erect, from three or four inches to a foot in height, smooth, annual, growing in April and May, and perishing in the course of the summer. The stipes is erect, smooth, of variable length, round, hollow and succulent, traversed by bundles of woody fibre; and becoming divided above into an entire ovate leaf-like sessile frond, and an erect linear stalked spike of fructification. The spore-cases are thus formed on the margins of a contracted branch of the frond. The frond is traversed by

[*Ophioglossum vulgatum*.]

irregular anastomosing slender veins. The fertile spike springs from the inner base of the leaf-branch, and is distinctly stalked, the stalk varying from an inch to several inches long: it is linear, very slightly tapering upwards, and consists of two lines or series of crowded marginal embedded spore-cases, opening transversely, the gaping concave cases when empty appearing like a series of spherical cavities along the margins. The fructification is mature in June. In some rare cases, more than one fertile spike is developed on each plant.

A local species, but generally exceedingly abundant where present, which is in moist pastures and meadow lands, where it is sometimes so abundant as for a time almost to usurp the place of the grasses. It is generally distributed over England, apparently less general in Wales, Scotland, and Ireland; and is also common in different parts of Europe.

Lightfoot says—"The common people sometimes make an ointment of the fresh leaves, and use it as a vulnerary to green wounds, which is a very ancient application." He also states that the *Botrychium* possesses similar vulnerary qualities.

This plant is not difficult of cultivation in a moist loamy soil, and a cool situation, and may be grown either in pots or planted out. It is nothing more than a curiosity; and owing to its prevalence, would hardly be considered even that, in the many localities where it grows naturally.

THE FERN ALLIES.

Though not having a very close botanical relationship with ferns, except in being like them acrogens, the Club-mosses, Quill-worts, Pepper-worts, and Horse-tails, are generally associated with them by cultivators.

The Club-mosses are called LYCOPODIACEÆ, and consist of leafy-stemmed moss-like plants with simple imbricated leaves, bearing fructification in their axils, either in the form of one-celled spore-cases called antheridia, containing numerous pulverous spores, or of 3-4 valved spore-cases, called oophoridia, containing large granular spores. This group includes the genera *Selaginella*, and *Lycopodium*.

The Pepper-worts — MARSILEACEÆ—are stemless tufted, or creeping aquatic plants, bearing their fructification either enclosed within the swollen base of the leaves, or in globular sessile spore-cases, with the leaves at intervals along the rhizome. In both forms the spores are of two dissimilar kinds. The genera *Isoëtes* and *Pilularia* belong to this group.

The Horse-tails, called EQUISETACEÆ, comprise the genus *Equisetum*, and consist of leafless branched plants having fistular jointed stems, with sheathing articulations, their fructification consisting of spore-cases attached to peltate scales, collected into terminal cones.

SELAGINELLA, *Spring.*

GEN. CHAR.—Fructification consisting of one-celled antheridia and 3-4 celled oophoridia.

1. **S. spinosa**, *Palisot de Beauvais*.—Stem prostrate, branches erect, nearly simple; leaves scattered lanceolate acute spinulose-ciliate spreading; spikes terminal.—On mountain bogs.—*S. selaginoides*, *Link*; *Lycopodium selaginoides*, *Linnaeus*.

LYCOPODIUM, *Linnaeus* (in part.)

GEN. CHAR.—Fructification consisting of one-celled antheridia only—no oophoridia.

Antheridia scattered: leaves similar.

1. **L. Selago**, *Linnaeus*.—Stem thick erect, forked; leaves, in eight rows, crowded elongate lanceolate mucronulate, convex beneath.—On mountain heaths.

Antheridia collected into a spike: leaves conformable equal around the stem.

2. **L. inundatum**, *Linnaeus*.—Stem prostrate; branches of two forms—the sterile prostrate, the fertile simple erect; leaves scattered crowded spreading sub-incurved entire, furrowed beneath; spike sessile inflated, bracts foliaceous.—On boggy heaths.

3. **L. annotinum**, *Linnaeus*.—Stem prostrate, the annual growth distinctly marked; branches erect forked elongate; leaves in five rows spreading or reflexed linear-lanceolate, irregularly subserrate pungent, nerved beneath; spike sessile terete.—On stony mountains.

4. **L. clavatum**, *Linnaeus*.—Stem prostrate, with distichous branches; leaves crowded in many rows, subsecund, incurved imbricate, linear-subulate with a hair-like point, nerved on both sides; spikes two or more, stalked; bracts suborbicular-acuminate, serrate.—On heaths.

Antheridia spiked: stem leaves of two forms.

5. **L. alpinum**, *Linnaeus*.—Stem elongate prostrate, with ascending flattened tufted branches; leaves in four rows, imbricate, the lateral ones lanceolate-falcate acute

keeled, concave on the inner side, the intermediate nearly three times smaller, subulate lanceolate; those of the fertile branches nearly equal; spike sessile terete.—On mountains.

ISOËTES, *Linnaeus*.

GEN. CHAR.—Fructification enclosed within the swollen base of the leaves.

1. **I. lacustris, *Linnaeus*.**—Quillwort.—Rhizome a blunt tuber; leaves subulate, roundish-quadrangular, with four longitudinal jointed tubes, broad and flat at the base.—In lakes and ponds.

PILULARIA, *Linnaeus*.

GEN. CHAR.—Fructification consisting of coriaceous four-celled spore-cases, seated on the rhizome.

1. **P. globulifera, *Linnaeus*.**—Pillwort.—Rhizome slender creeping leafy at intervals; leaves very slender erect; spore-cases axillary nearly spherical, hairy.—On the margin of ponds and lakes.

EQUISETUM, *Linnaeus*.

GEN. CHAR.—Fructification forming terminal cones, the spore-cases attached to peltate scales.

Fertile and barren stems dissimilar.

1. **E. Telmateia, *Ehrhart*.**—Barren stems smooth with 30 ridges, branched: sheaths of branches with subulate two-ribbed teeth; fertile simple short, with large crowded 30-40 toothed sheaths.—In muddy places.

2. **E. umbrosum, *Willdenow*.**—Barren stems rough, with 20 ridges, branched: sheaths of branches with subulate one-ribbed teeth; fertile simple short, with crowded pallid 12-20 toothed sheaths.—In damp glens.]

3. **E. arvense, *Linnaeus*.**—Barren stems roughish with 10-16 ridges, branched: sheaths of branches with

long acute one-ribbed teeth; fertile simple short with few distant sheaths.—In damp meadows and fields.

Stems similar, simple or branched.

4. **E. sylvaticum**, *Linnaeus*.—Stems with about 12 ridges; branches deflexed; sheaths loose, terminating in 3-4 blunt lobes.—In damp woods.

5. **E. limosum**, *Linnaeus*.—Stems smooth with numerous slight ridges; branches short erect few, often wanting; sheaths green close with 16-20 sharp-pointed dark teeth.—In marshy places and ditches.

6. **E. palustre**, *Linnaeus*.—Stems roughish with 6-8 broad prominent ridges; branches erect; sheaths pale loose with acute wedge-shaped brown-tipped teeth.—In boggy or marshy places.

7. **E. Mackaili**, *Newman*.—Stems very rough with 8-12 ridges, almost or quite branchless; sheaths close, at first green, with a black band, ultimately wholly black with narrow subulate persistent teeth.—In mountain glens.

8. **E. hyemale**, *Linnaeus*.—Stems very rough with 14-20 ridges, branchless; sheaths close whitish banded with black at top and bottom, their teeth slender deciduous.—In damp woods.

9. **E. variegatum**, *Weber and Mohr*.—Stems very rough with 4-10 ridges, almost or quite branchless; sheaths slightly enlarged upwards, green below black above, with obtuse teeth tipped by a deciduous bristle.—On sandy coasts, and wet sandy places.—*E. Wilsoni*, *Newman*, is a form with less rough taller stems.



A D D E N D A.

The following additions have become necessary while this edition has been going through the press:—

Page 50, under POLYPODIUM ALPESTRE, insert:—

P. flexile, (Pseudathyrium, *Newman. Newm.*)—"Habit lax flexile. Frond strap-shaped spreading horizontally, 8-18 in. long, bipinnate; pinnæ distant throughout, horizontal or drooping, subobtuse; pinnules 7-10 on each side of midrib of pinnæ, narrower at base, distant, subobtuse serrated; clusters of capsules 6-8 on each pinnule, distant, always separate.—On micaceous rocks at the head of Glen Prosen, Clova Mountains, Forfarshire, *Mr. J. Backhouse*" (*Phytol.* iv., 974).

P. alpestre is said to differ from this plant in being of a rigid habit; and in having suberect lanceolate fronds, with ascending subacute pinnæ distant near the base but elsewhere crowded; the pinnules wider at the base crowded and numbering 25-35 on each side the midrib of pinnæ, twenty-five or more clusters of capsules being borne on each pinnule, these clusters crowded and finally confluent. I am not sufficiently acquainted with *P. flexile* to form an opinion as to its distinctness, but I fear the differences pointed out only indicate a form of *P. alpestre*, influenced by the conditions of the locality which has produced it, the peculiarities having perhaps acquired the value of a permanent variation.

Mr. Backhouse informs me that the peculiarities of this plant are not the result of shade, as it was found growing in less shady situations than those in which the ordinary form of *P. alpestre* was met with.

Page 62, under GYMNOGRAMMA LEPTOPHYLLA, insert:—

The spontaneous occurrence of this fern in Jersey is confirmed. It appears to be a true native of the island,

and not intentionally introduced, as had been suggested in the *Phytologist*, being found to be widely dispersed, occurring in several places near St. Laurence, near St. Aubyns, and elsewhere. It is found on the moist banks of exposed lanes having a southern aspect. I learn from N. B. Ward, Esq., that in one of two localities in which he has seen it, the fern had been abundant in the early spring, but being annual like some of our smaller trefoils, it had withered by the end of July. It exists, no doubt, in other parts of the island than those in which it has as yet been met with, but being of very small size and growing on banks covered with other vegetation, is easily overlooked.

Page 122, under *LASTREA SPINULOSA*, insert:—

This fern undoubtedly occurs in Scotland. I have recently been favoured with specimens gathered at Dunkeld, in Perthshire, by Mr. A. Tait, of Edinburgh, who states that it was growing sparingly among a profusion of *L. dilatata*, and under apparently identical conditions.

Page 135, under *LASTREA FCENISECII*, insert:—

W. H. Allchin, Esq., has found near Festiniog, in N. Wales, a small form of this plant, but having the parts considerably narrowed, which seems to connect the ordinary form of the species with a narrowed Madeira form which I suppose to be the var. *productum* of Mr. Lowe.

The following additions to the table given at pp. 18—19 are necessary:—

<i>Gymnogramma leptophylla</i>	.	occurs in	{ Prov. 24 (!).
			{ Prov. 15 (?).
<i>Lastrea spinulosa</i>	.	occurs in	Prov. 15 (!).
<i>Pteris aquilina</i>	.	occurs in	Prov. 24 (!).

I N D E X.

	Page
ACROPTERIS, <i>Link.</i>	
septentrionalis, <i>Link.</i> ..	171
ACROSTICHUM, <i>Linnæus.</i>	
alpinum, <i>Bolt.</i> ..	69
hyperboreum, <i>Lilj.</i> ..	69
livense, <i>Lin.</i> ..	66
leptophyllum, <i>De Cand.</i>	62
Thelypteris, <i>Lin.</i> ..	98
septentrionale, <i>Lin.</i> ..	171
Spicant, <i>Sibth.</i> ..	185
ADIANTUM, <i>Linnæus</i> 42,	196
CAPILLUS-VENERIS, <i>Lin.</i>	196
Capillus, <i>Link.</i> ..	196
ALLOSORUS, <i>Bernh.</i> ..	36, 58
CRISPUS, <i>Bernh.</i> ..	58
AMESIUM, <i>Newman.</i>	
germanicum, <i>Newm.</i> ..	169
Ruta-muraria, <i>Newm.</i> ..	167
septentrionale, <i>Newm.</i> ..	171
ANOGRAMMA, <i>Link.</i>	
leptophylla, <i>Link.</i> ..	62
ASPIDIUM, <i>Swartz.</i>	
aculeatum, <i>Kunze.</i> ..	91
aculeatum, <i>Swartz.</i> ..	86
affine, <i>Fisch. et Mey.</i> ..	103
alpestre, <i>Hoppe.</i> ..	50

	Page
angulare, <i>Willd.</i> ..	91
cristatum, <i>Swartz.</i> ..	115
dentatum, <i>Swartz.</i> ..	73
depastum, <i>Schkuhr.</i> ..	103
dilatatum, <i>Smith.</i> ..	123
— recurvum ..	132
— concavum ..	132
dumetorum, <i>Smith.</i> ..	124
erosum, <i>Schkuhr.</i> ..	103
Felix-mas, <i>Swartz.</i> ..	103
— erosum, <i>Hook & Arn.</i>	103
— recurvum ..	104
Felix-fœmina, <i>Swartz.</i> ..	139
fontanum, <i>Swartz.</i> ..	150
fragile, <i>Swartz.</i> ..	73
fragrans, <i>Gray.</i> ..	111
Halleri, <i>Willd.</i> ..	150
irriguum, <i>Smith.</i> ..	137
lobatum, <i>Swartz.</i> ..	86
Lonchitis, <i>Swartz.</i> ..	84
montanum, <i>Swartz.</i> ..	80
Oreopteris, <i>Swartz.</i> ..	100
recurvum, <i>Bree.</i> ..	132
regium, <i>Swartz.</i> ..	78
rhæticum, <i>Swartz.</i> ..	50
rigidum, <i>Swartz.</i> ..	111
spinulosum, <i>Smith.</i> ..	124
spinnosum, <i>Swartz.</i> ..	126
— uliginosum, <i>A. Braun.</i>	115
Thelypteris, <i>Swartz.</i> ..	98
ASPLENIUM, <i>Linnæus</i> 40,	149
acutum, <i>Bory.</i> ..	155
ADIANTUM NIGRUM, <i>Lin.</i>	155

	Page		Page
β . OBTUSUM ..	155, 157	γ . RAMOSUM ..	141, 146
γ . ACUTUM ..	155, 157	η , CRISPUM ..	141, 147
δ . VARIEGATUM ..	155, 158	— convexum ..	.. 136
alternifolium, <i>Wulf.</i> ..	169	— rhæticum ..	.. 136
Billotii, <i>F. Schultz</i> ..	153	— incisum ..	.. 139
Breynii, <i>Retz.</i> ..	169	— vivipara ..	.. 141
Ceterach, <i>Lin.</i> ..	181	— furcatum ..	.. 141
Filix-fœmina, <i>Bernh.</i> ..	139	fontanum, <i>Roehl</i> ..	.. 150
— latifolium ..	.. 139	Halleri, <i>Roth</i> ..	.. 150
— molle ..	.. 139	incisum, <i>Newm.</i> ..	.. 139
FONTANUM, <i>Bernh.</i> ..	150	latifolium, <i>Bab.</i> ..	.. 139
GERMANICUM, <i>Weiss</i> ..	169	molle, <i>Roth</i> ..	.. 139
Halleri, <i>Brown</i> ..	150	ovatum, <i>Newm.</i> ..	.. 139
LANCEOLATUM, <i>Huds.</i> ..	152	RHÆTICUM, <i>Roth</i> ..	.. 136
leptophyllum, <i>Cav.</i> ..	62	trifidum, <i>Roth</i> ..	.. 139
MARINUM, <i>Lin.</i> ..	159	BLECHNUM, <i>Lin.</i> ..	41, 185
β . ACUTUM ..	.. 159	boreale, <i>Swartz</i> ..	.. 185
murale, <i>Bernh.</i> ..	167	SPICANT, <i>Roth</i> ..	.. 185
nigrum, <i>Bernh.</i> ..	155	β . RAMOSUM ..	.. 187
obtusum, <i>Willd.</i> ..	155	BOTRYCHIUM, <i>Swartz.</i> ..	42, 215
rotundatum, <i>Kaulf.</i> ..	153	LUNARIA, <i>Lin.</i> ..	.. 215
RUTA-MURARIA, <i>Lin.</i> ..	167	CETERACH, <i>Willd.</i> ..	41, 181
Scolopendrium, <i>Lin.</i> ..	174	officinatum, <i>Willd.</i> ..	.. 181
SEPTENTRIONALE, <i>Hull</i> ..	170	CRYPTOGRAMMA, <i>R. Br.</i> ..	.. 58
Spicant, <i>Bernh.</i> ..	185	crispa, <i>R. Br.</i> ..	.. 58
TRICHOMANES, <i>Lin.</i> ..	162	CTENOPTERIS, <i>Newm.</i> ..	.. 43
β . INCISUM ..	.. 162	vulgaris, <i>Newm.</i> ..	.. 43
Trichomanes ramosum,		CYATHEA, <i>Smith.</i> ..	.. 73
<i>Lin.</i> ..	.. 165	anthriscifolia, <i>Roth</i> ..	.. 73
trichomanoides, <i>Schkr.</i> ..	162	cynapifolia, <i>Roth</i> ..	.. 73
Virgilii, <i>Bory.</i> ..	155	dentata, <i>Smith.</i> ..	.. 73
VIRIDE, <i>Huds.</i> ..	165	fragilis, <i>Smith.</i> ..	.. 73
β . ACUTUM ..	.. 165	incisa, <i>Smith.</i> ..	.. 78
ATHYRIUM, <i>Roth.</i> ..	39, 136	montana, <i>Roth.</i> ..	.. 80
convexum, <i>Newm.</i> ..	137	regia, <i>Forster</i> ..	.. 78
FILIX-FŒMINA, <i>Roth</i> ..	138	CYSTEIA, <i>Smith.</i> ..	.. 73
β . LATIFOLIUM ..	139, 143	angustata, <i>Smith</i> ..	.. 73
γ . MOLLE ..	139, 144		
δ . MARINUM ..	139, 145		
ϵ . MULTIFIDUM ..	141, 146		

	Page		Page
dentata, <i>Smith</i> ..	73	GYMNOCARPIUM, <i>Newm.</i>	
fragilis, <i>Smith</i> ..	73	Dryopteris, <i>Newm.</i> ..	53
regia, <i>Smith</i> ..	78	Phegopteris, <i>Newm.</i> ..	47
		Robertianum, <i>Newm.</i> ..	55
CYSTOPTERIS, <i>Bernh.</i> 37, 71		GYMNOGRAMMA,	
Allioni, <i>Newm.</i> ..	80	Desvauz ..	36, 62
ALPINA, <i>Desvauz</i> ..	78	Ceterach, <i>Sprengel</i> ..	181
dentata, <i>Hook.</i> ..	73	LEPTOPHYLLA, <i>Desv.</i> 62, 225	
Dickleana, <i>Sim.</i> ..	73		
FRAGILIS, <i>Bernh.</i> ..	71	HEMESTHEUM, <i>Newm.</i>	
α. VULGARIS ..	71	montanum, <i>Newm.</i> ..	100
β. ANGUSTATA ..	73, 75	Thelypteris, <i>Newm.</i> ..	98
γ. DENTATA ..	73, 76		
δ. DICKIEANA ..	73, 76	HYMENOPHYLLUM,	
MONTANA, <i>Link.</i> ..	80	Smith ..	42, 207
regia, <i>Presl</i> ..	78	alatum, <i>Smith</i> ..	199
		TUNBRIDGENSE, <i>Smith.</i> ..	207
DIDYMOGLOSSUM, <i>Desvauz.</i>		UNILATERALE, <i>Willd.</i> ..	209
alatum, <i>Desv.</i> ..	199	Wilsoni, <i>Hooker</i> ..	209
DRYOPTERIS, <i>Adans.</i>		ISOËTES, <i>Linnaeus</i> ..	223
Filix-mas, <i>Schott</i> ..	103	LACUSTRIS, <i>Lin.</i> ..	223
EQUISETUM, <i>Linnaeus</i> 223			
ARVENSE, <i>Lin.</i> ..	223	LASTREA, <i>Presl</i> ..	38, 97
HYEMALE, <i>Lin.</i> ..	224	calcarea, <i>Newm.</i> ..	55
LIMOSUM, <i>Lin.</i> ..	224	Callipteris, <i>Newm.</i> ..	115
MACKAIL, <i>Newm.</i> ..	224	collina, <i>Newm.</i> ..	123
PALUSTRE, <i>Lin.</i> ..	224	CRISTATA, <i>Presl</i> ..	114
SYLVATICUM, <i>Lin.</i> ..	224	β. ULIGINOSA ..	115, 118
TELMATEIA, <i>Ehrhart</i> ...	223	γ. SPINULOSA ..	115, 119, 226
UMBROSUM, <i>Willd.</i> ..	223	DILATATA, <i>Presl</i> ..	122
VARIEGATUM, <i>Web. et M.</i> 224		β. COLLINA ..	123, 127
Wilsoni, <i>Newm.</i> ..	224	γ. SMITHII ..	123, 129
		δ. DUMETORUM ..	124, 130
EUPTERIS, <i>Newman.</i>		ε. ANGUSTA ..	124, 130
aquilina, <i>Newm.</i> ..	189	. MACULATA ..	124, 130
GRAMMITIS, <i>Swartz.</i>		η. GLANDULOSA ..	124, 131
Ceterach, <i>Swartz</i> ..	181	— linearis ..	115
leptopylla, <i>Swartz</i> ..	62	Dryopteris, <i>Newm.</i> ..	53
		erosa, <i>Deak.</i> ..	103
		FILIX-MAS, <i>Presl</i> ..	103
		β. INCISA ..	103, 107

	Page		Page
<i>γ. ABBREVIATA</i>	103, 108	<i>NOTOLEPEUM, Newm.</i>	
<i>δ. CRISTATA</i>	106, 109	<i>Ceterach, Newm.</i>	.. 181
<i>FENISECII, Watson</i>	132, 226	<i>ONOCLEA, Linnæus.</i>	
<i>glandulosa, Newm.</i>	.. 124	<i>Spicant, Hoffm.</i>	.. 185
<i>maculata, Deakin</i>	.. 124	<i>OPHIOGLOSSUM,</i>	
<i>montana, Moore</i>	.. 100	<i>Linnæus.</i>	42, 218
<i>multiflora, Newm.</i>	.. 123	<i>VULGATUM, Lin.</i>	.. 218
<i>— collina</i>	.. 123	<i>OSMUNDA, Linnæus.</i>	42, 211
<i>OREOPTERIS, Presl.</i>	.. 100	<i>borealis, Salisb.</i>	.. 185
<i>Phegopteris, Newm.</i>	.. 47	<i>crispa, Lin.</i>	.. 58
<i>recurva, Newm.</i>	.. 132	<i>leptophylla, Lam.</i>	.. 62
<i>RIGIDA, Presl</i>	.. 111	<i>Lunaria, Lin.</i>	.. 215
<i>Robertiana, Newm.</i>	.. 55	<i>REGALIS, Lin.</i>	.. 211
<i>spinosa, Newm.</i>	.. 115	<i>Spicant, Lin.</i>	.. 185
<i>spinulosa, Presl</i>	.. 115	<i>PHEGOPTERIS, Fee.</i>	
<i>THELYPTERIS, Presl</i>	.. 98	<i>calcarea, Fee</i>	.. 55
<i>uliginosa, Newm.</i>	.. 115	<i>Dryopteris, Fee</i>	.. 53
<i>LOMARIA, Willdenow.</i>		<i>polypodioides, Fee</i>	.. 49
<i>Spicant, Desv.</i>	.. 185	<i>PHOROLOBUS, Desvauz.</i>	
<i>LOPHODIUM, Newman.</i>		<i>crispus, Desv.</i>	.. 58
<i>abbreviatum, Newm.</i>	.. 104	<i>PHYLLITIS, Auct.</i>	
<i>Callipteris, Newm.</i>	.. 115	<i>heterophylla, Mœnch</i>	169
<i>collinum, Newm.</i>	.. 123	<i>lancifolia, Mœnch</i>	.. 155
<i>erosum, Newm.</i>	.. 103	<i>multifida, Ray</i>	.. 175
<i>Filix-mas, Newm.</i>	.. 103	<i>polyschides, Ray</i>	.. 174
<i>glanduliferum, Newm.</i>	124	<i>rotundifolia, Mœnch</i>	.. 162
<i>glandulosum, Newm.</i>	.. 124	<i>Ruta-muraria, Mœnch</i>	167
<i>multiflorum, Newm.</i>	.. 123	<i>Scolopendrium, Newm.</i>	174
<i>spinosum, Newm.</i>	.. 115	<i>PILULARIA, Linnæus</i>	.. 223
<i>LYCOPODIUM, Linnæus.</i>	222	<i>GLOBULIFERA, Lin.</i>	.. 223
<i>ALPINUM, Lin.</i>	.. 222	<i>POLYPODIUM, Lin-</i>	
<i>ANNOTINUM, Lin.</i>	.. 222	<i>næus.</i>	.. 36, 43
<i>CLAVATUM, Lin.</i>	.. 222	<i>aculeatum, Lin.</i>	.. 86
<i>INUNDATUM, Lin.</i>	.. 222	<i>ALPESTRE, Sprengel</i>	.. 50
<i>selaginoides, Lin.</i>	.. 222	<i>alpinum, Jacq.</i>	.. 78
<i>SELAGO, Lin.</i>	.. 222	<i>anthriscifolium, Hoffm.</i>	73
<i>NEPHRODIUM, Richard.</i>			
<i>fœniseçii, Lowe</i>	.. 132		

	Page		Page
aristatum, <i>Villars</i>	.. 123	γ. SERRATUM	.. 44
arvonicum, <i>With.</i>	.. 69	δ. CAMBRICUM	.. 44
calcareum, <i>Smith</i>	.. 55	ε. HIBERNICUM	.. 44
Callipteris, <i>Ehrh.</i>	.. 115		
cambricum, <i>Lin.</i>	.. 44	POLYSTICHUM, <i>Schott.</i>	37, 83
cristatum, <i>Lin.</i>	.. 115	abbreviatum, <i>De Cand.</i>	104
cristatum, <i>Huds.</i>	.. 123	ACULEATUM, <i>Roth</i>	.. 86
eynapifolium, <i>Hoffm.</i>	.. 73	β. OBTUSUM	.. 86, 90
dentatum, <i>Dickson</i>	.. 73	γ. LOBATUM	.. 86, 90
dilatatum, <i>Hoffm.</i>	.. 123	δ. ALATUM	.. 86, 91
DRYOPTERIS, <i>Lin.</i>	.. 53	ANGULARE, <i>Presl</i>	.. 91
Filix-fœmina, <i>Lin.</i>	.. 139	β. SUBTRIPINNATUM	.. 91, 95
— spinosa, <i>Weiss</i>	.. 115	γ. ANGUSTATUM	.. 91, 95
Filix-mas, <i>Lin.</i>	.. 103	— VIVIPARUM	.. 95
flexile .. ..	.. 225	cristatum, <i>Roth</i>	.. 115
fontanum, <i>Lin.</i>	.. 150	Dryopteris, <i>Roth</i>	.. 53
fragile, <i>Lin.</i>	.. 73	Filix-mas, <i>Roth</i>	.. 103
fragrans, <i>Lin.</i>	.. 111	lobatum, <i>Presl</i>	.. 86
Heleopteris, <i>Borkh.</i>	.. 103	lonchitidiodes, <i>Auct.</i>	.. 86
hyperboreum, <i>Swartz.</i>	.. 69	LONGCHITIS, <i>Roth</i>	.. 83
— gracile, <i>Wahl.</i>	.. 69	montanum, <i>Roth</i>	.. 100
ilvense, <i>Swartz</i>	.. 66	multiflorum, <i>Roth</i>	.. 123
incisum, <i>Hoffm.</i>	.. 139	Pheopteris, <i>Roth</i>	.. 47
leptophyllum, <i>Lin.</i>	.. 62	spinosum, <i>Roth</i>	.. 115
lobatum, <i>Huds.</i>	.. 86	strigosum, <i>Roth</i>	.. 111
Lonchitis, <i>Lin.</i>	.. 84	Thelypteris, <i>Roth</i>	.. 98
molle, <i>Schreb.</i>	.. 139		
montanum, <i>Vogler</i>	.. 100	PSEUDATHYRIUM, <i>Newm.</i>	
montanum, <i>Allioni</i>	.. 80	alpestre, <i>Newm.</i>	.. 50
Oreopteris, <i>Ehrh.</i>	.. 100	flexile, <i>Newm.</i>	.. 225
pedicularifolium, <i>Hoffm.</i>	.. 150		
PHEOPTERIS, <i>Lin.</i>	.. 47	PTERIS, <i>Linnaeus.</i>	42, 189
polymorphum, <i>Villars</i>	.. 73	AQUILINA, <i>Lin.</i>	.. 189
regium, <i>Lin.</i>	.. 78	α. VERA ..	.. 189
rhæticum, <i>Woods</i>	.. 50	β. INTEGERRIMA	190, 193
rhæticum, <i>Lin.</i>	.. 137	crispa, <i>Lin.</i>	.. 58
rigidum, <i>Hoffm.</i>	.. 111	septentrionalis, <i>Sm.</i>	.. 171
ROBERTIANUM, <i>Hoffm.</i>	.. 55		
spinulosum, <i>Mull</i>	.. 115	SCOLOPENDRIUM, <i>Sm.</i>	41, 173
Thelypteris, <i>Lin.</i>	.. 98	alternifolium, <i>Roth.</i>	.. 169
trifidum, <i>Hoffm.</i>	.. 139	Ceterach, <i>Symons</i>	.. 181
trifidum, <i>With.</i>	.. 73	officinarum, <i>Swartz.</i>	.. 174
VULGARE, <i>Lin.</i>	.. 43		
β. BIFIDUM	.. 44		

University of California
SOUTHERN REGIONAL LIBRARY FACILITY
Return this material to the library
from which it was borrowed.

REC'D LD-UK

MAY 9 1988

UC SOUTHERN REGIONAL LIBRARY FACILITY



A 000 188 862 7

UNIVERSITY

REGION